DOCUMENT RESUME

ED 173 552 CE 019 970

AUTHOR Kim, Jin Eun
TITLE Developmental Strategies and Analytical Techniques for Improving the Cost-Effectiveness of Vocational Programs. Handbook.
INSTITUTION Indiana Univ., Bloomington. Dept. of Vocational Education.
SPONS AGENCY Bureau of Occupational and Adult Education (DHEW/CE), Washington, D.C.; Indiana State Board of Vocational and Technical Education, Indianapolis.
PUB DATE Dec 78
GRANT IN-V-713-N
NOTE 160p.; For related documents see CE 019 968-969

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Accountability; *Administrative Personnel; *Cost Effectiveness; Educational Administration; Program Administration; *Program Effectiveness; *Program Evaluation; *Program Improvement; Resource Allocations; Speeches; Statewide Planning; Training; *Vocational Education; Workshops

ABSTRACT

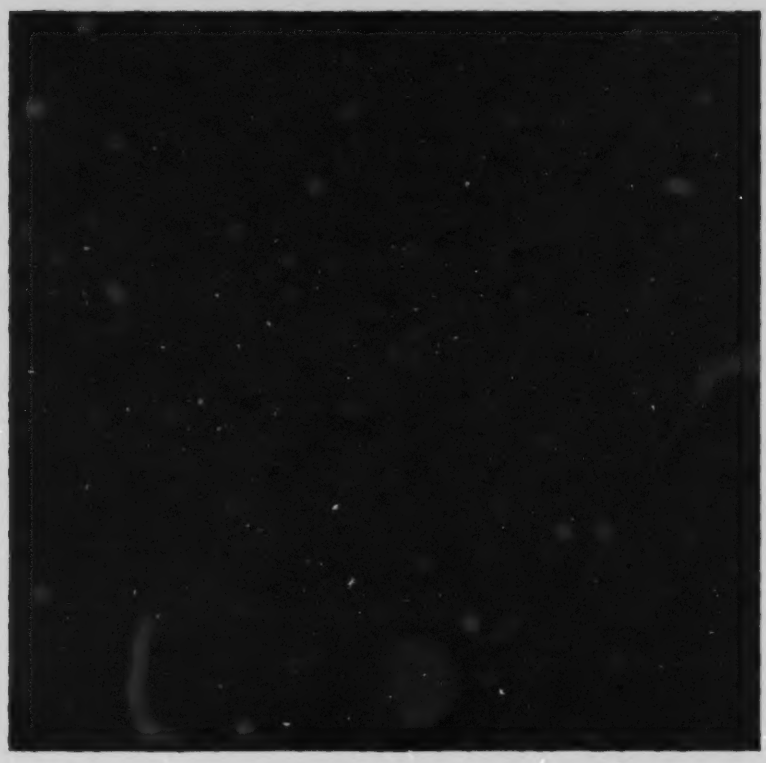
This handbook was developed to assist vocational administrators in (1) developing strategies for goal-setting and resource allocation, (2) identifying potential problems, (3) analyzing cost-effectiveness of vocational programs, and (4) improving managerial skills using information from the analysis in the decision-making process. The handbook includes six strategy papers, the procedures and results of nominal group meetings, and small group workshop activities. Strategy papers presented to the workshop include "Inside the Black Box: Process Evaluation as a Part of Cost-Effectiveness/Benefit Analysis," by Lois-ellin Datta; "Increasing the Cost Efficiency of Vocational Education," by James Pershing; "Improving the Cost-Effectiveness of Vocational Programs," by George Copa; "Determining Program Objectives and Outputs," by Roderick McKinney; "Analyzing Program Cost," by Don Pennington; and "Computing the Cost-Effectiveness Measures for Vocational Education Programs," by Jin Eun Kim. A list of program objectives and target goals and an example program cost analysis form are appended. (Author/LRA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED173552

HANDBOOK

DEVELOPMENTAL STRATEGIES AND ANALYTICAL TECHNIQUES FOR IMPROVING THE COST-EFFECTIVENESS OF VOCATIONAL PROGRAMS



Jin Eun Kim

Department of Vocational Education
School of Education, Indiana University
Bloomington, Indiana

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

December, 1978

Bureau of Occupational and Adult Education, U.S. Office of Education
Department of Health, Education and Welfare
and
Indiana State Board of Vocational and Technical Education

CE 019 970

COST-EFFECTIVENESS STUDY PROJECTS

IN

VOCATIONAL EDUCATION

Project Director: Jin Eun Kim

1. *Development of A Cost-Effectiveness Analysis Model and Administrator's Manual for Secondary Vocational Programs: July 1, 1975 -- June 30, 1976.*

2. *Development of A Cost-Effectiveness/Benefit Analysis Model and User's Manual for Postsecondary Vocational Programs: July 1, 1976 -- October 31, 1977.*

3. *Diffusion of the Cost-Effectiveness Analysis System for Improving Secondary Vocational Program Management: January 1, 1977 -- March 31, 1978.*

4. *National Priority Training Program #1: Developmental Strategies and Analytical Techniques for Improving the Cost-Effectiveness of Vocational Programs: July 1, 1977 -- December 31, 1978.*

Project Information

TITLE: NATIONAL PRIORITY TRAINING PROGRAM #1: DEVELOPMENTAL STRATEGIES AND ANALYTICAL TECHNIQUES FOR IMPROVING THE COST-EFFECTIVENESS OF VOCATIONAL PROGRAMS

GRANTOR: Bureau of Occupational and Adult Education
U.S. Office of Education

GRANT: IN-V-713-N (EPDA, Part F, Section 553)

GRANTEE: Indiana University Foundation
Bloomington, Indiana

PROJECT STAFF:

Principal Investigator and Project Director

Dr. Jin Eun Kim, Assistant Professor and
Project Director, Cost-Effectiveness Studies
in Vocational Education
School of Education
Indiana University-Bloomington

Project Assistants

Mr. Jerry Havill
Department of Vocational Education

Ms. Vicki Neaves
School of Environmental and Public Affairs

Staff

Mr. John Briggs, Editor

Ms. Diana Dicus, Administrative Secretary

Ms. Susan Schneider, Typist

Ms. Barbara White, Typist

The project reported in this publication was conducted under government sponsorship, and its author was encouraged to express freely his judgments in professional and technical matters. Points of view in the report do not necessarily represent policies of the funding agency.

ABSTRACT

Purpose. This handbook was developed as a part of the national priority training project on improving the cost-effectiveness of vocational programs. It has been prepared to assist vocational administrators in: (1) developing strategies for goal-setting and resource allocation, (2) identifying potential problems, (3) analyzing cost-effectiveness of vocational programs, and (4) improving managerial skills using information from the analysis in the decision-making process.

Procedures. The handbook resulted from the national workshop which was designed to make the participants aware of cost-effectiveness strategies and techniques and train them to become change agents in their respective states. The cost-effectiveness concept was defined for training purposes as: (1) a developmental strategy, and (2) an analytical technique.

For the developmental perspective, three guest speakers were invited to present strategy papers, and the Nominal Group Technique (NGT) was applied to identify priority problems in the developmental strategies. For analytical purposes, three technique papers were presented on techniques of cost-effectiveness analysis of vocational programs. Small groups practiced the analytical techniques using hypothetical information and data forms. The six papers presented at the workshop and the procedures and results of the small group activities are combined in this handbook.

Products. The handbook consists of two major parts. The first part includes three strategy papers (Chapters II, III, and IV) and the procedures and results of nominal group meetings (Chapter V); the second part includes three analytical papers (Chapter VI, VII, and VIII) and small group workshop activities (Chapter IX). The final chapter draws conclusions.

Acknowledgements

The project director wishes to acknowledge the Bureau of Occupational and Adult Education, the U.S. Office of Education, for its financial support of this project, and the Indiana State Board of Vocational and Technical Education for its co-sponsorship with the USOE. Special appreciation is expressed to Ms. Muriel Shay Tapman, National Coordinator for VEPD in the Bureau, Mr. Daryl Nichols, the former Program Officer, OAE, USOE Region Office V, and Dr. Mary Jenet Penrod, State Coordinator for Supportive Services and Program Improvement at the Indiana State Board, for their cooperation, assistance, and encouragement.

The author is most grateful to the Executive Committee and the Planning and Evaluation Committee members for their advice and assistance in planning and implementing the national workshop. The gratefulness is extended to the contributors to the workshop and the participating states' state directors and team members for their recognition of and involvement in the training program. Special indebtedness is acknowledged to paper presenters, group leaders, and project assistants for their academic contribution and professional services.

In addition, sincere thanks go to Dr. Thomas R. White, Chairperson of the Department of Vocational Education and the departmental staff for their help and assistance with the project, the editing and the typing of this report.

J.E.K.

PROGRAM MONITORS

Ms. Muriel Shay Tapman
National Coordinator, VEPD
Bureau of Occupational and
Adult Education
U.S. Office of Education
Washington, DC

Dr. Mary Jenet Penrod
State Coordinator
Supportive Services and
Program Improvement
State Board of Vocational
and Technical Education
Indianapolis, IN

Mr. Daryl Nichols
Program Officer, OAE
USOE Regional Office V
Chicago, IL

CENTRAL AND REGIONAL LIAISONS

Mr. Harold F. Duis
Program Specialist, OAE
U.S. Office of Education
Washington, DC

Mr. Homer E. Edwards
Acting Assistant Regional
Commissioner, OAE
USOE Regional Office V
Chicago, IL

EXECUTIVE COMMITTEE MEMBERS

Dr. Paula Carter
Associate Superintendent
State Department of Education
Indianapolis, IN

Dr. Don Pennington
Vocational Director
MSD of Washington Township
Indianapolis, IN

Dr. Don Gentry
Executive Officer/State Director
State Board of Vocational
and Technical Education
Indianapolis, IN

Dr. Mary Jenet Penrod
State Coordinator
Supportive Services and
Program Improvement
State Board of Vocational
and Technical Education
Indianapolis, IN

Dr. Thomas R. White, Chairperson
Department of Vocational Education
Indiana University
Bloomington, IN

PLANNING AND EVALUATION COMMITTEE MEMBERS

(By Region)

REGION I:

Mr. Sidney Cohen
Personnel Development Coordinator
State Board for Vocational Education
State Department of Education
Hartford, CT

REGION II:

Dr. John Grieco
Division of Vocational Education
State Department of Education
Trenton, NJ

REGION III:

Dr. Carroll Curtis
RCU Director
State Board for Vocational Education
Harrisburg, PA

REGION IV:

Dr. Roy Giehls
Program Director of Evaluation
Division of Vocational Education
State Department of Education
Tallahassee, FL

REGION V:

Mr. Roderick McKinney
Vocational Director
Benton Community Schools
Fowler, IN

Region VI:

Dr. Arch Alexander
Deputy State Director
State Board of Vocational
and Technical Education
Stillwater, OK

REGION VII:

Mr. B.W. Robinson
Assistant Commissioner
Career and Adult Education
State Department of Education
Jefferson, MO

REGION VIII:

Dr. Robert Perry
State Coordinator
State Board for Community
Colleges and Occupational
Education
Denver, CO

REGION IX:

Dr. Robert V. Kerwood
Curriculum and Professional
Development Director
State Department of Education
Phoenix, AZ

REGION X:

Mr. Don Austin
Curriculum Specialist
State Board of Vocational
Education
State Department of Education
Salem, OR

PAPER CONTRIBUTORS

(In Alphabetical Order)

Dr. George Copa, Professor and Associate Director, Minnesota R & D Center for Vocational and Technical Education, University of Minnesota.
Paper Title: Improving the Cost-Effectiveness of Vocational Education Programs

Dr. Lois-ellin Datta, Assistant Director, Learning and Teaching Group, National Institute of Education.
Paper Title: Inside the Black Box: Process Evaluation as a part of Cost-Effectiveness/Benefit Analysis

Dr. Jin Eun Kim, Assistant Professor and Project Director, Cost-Effectiveness Studies in Vocational Education, Indiana University-Bloomington.
Paper Title: Computing the Cost-Effectiveness Measures for Vocational Education Programs

Mr. Roderick McKinney, Vocational Director, Benton Community Area Vocational School.
Paper Title: Determining Program Objectives and Outputs

Dr. Don Pennington, Vocational Director, Washington Township, Indianapolis, Indiana.
Paper Title: Analyzing Program Costs in Vocational Education

Dr. James Pershing, Assistant Professor, Department of Vocational Education, Indiana University-Bloomington.
Paper Title: Increasing the Cost Efficiency of Vocational Education

Table of Contents

		PAGE
CHAPTER I:	INTRODUCTION	1
	Objectives of the Handbook	1
	Development of the Handbook	2
	Organization of the Handbook	3
CHAPTER II:	INSIDE THE BLACK BOX: PROCESS EVALUATION AS A PART OF COST-EFFECTIVENESS/BENEFIT ANALYSIS by Lois-ellin Datta	7
	Why We Need to Get Inside the Black Box: Two Examples	9
	Understanding the Data: Some Possible Reasons for Ineffective Programs	14
	Finding Out: Planning for Program Information	24
	Strategies for Improving Vocational Program Effectiveness	27
	References	32
CHAPTER III:	INCREASING THE COST EFFICIENCY OF VOCATIONAL EDUCATION by James A. Pershing	33
	Prologue to Understanding Cost Efficiency	33
	Cost Efficiency and Vocational Education	38
	Climate of Beliefs for Utilizing Cost Efficiency Analysis	47
	References	49
CHAPTER IV:	IMPROVING THE COST-EFFECTIVENESS OF VOCATIONAL EDUCATION PROGRAMS by George Copa	51
	Major Management Decisions Affecting Vocational Education	52
	Alternative Concepts of the Purpose of Vocational Education	55
	Using Economic Principles in Improving Cost-Effectiveness of Vocational Education	59
	Summary	77
	References	78

TABLE OF CONTENTS, *continued*

		PAGE
CHAPTER V:	NOMINAL GROUP MEETING FOR PROBLEM EXPLORATION	79
	The Nature and Process of Nominal Group Meeting	79
	Problems in Developmental Strategies	84
	References	91
CHAPTER VI:	DETERMINING PROGRAM OBJECTIVES AND OUTPUTS by Roderick McKinney	93
	Rationale for Determining Program Objectives and Outputs	94
	Indiana Model: Program Objectives and Target Goals	95
	Training and Experience at the Indiana State Conference	97
	Practical Application	98
	Summary	99
CHAPTER VII:	ANALYZING PROGRAM COSTS IN VOCATIONAL EDUCATION by Don Pennington	101
	Rationale for Program Cost Analysis	101
	Indiana Model: Program Cost Analysis	105
	Practical Implications	107
CHAPTER VIII:	COMPUTING THE COST-EFFECTIVENESS MEASURES FOR VOCATIONAL EDUCATION PROGRAMS by Jin Eun Kim	111
	Rationale for Cost-Effectiveness Analysis	111
	Indiana Model: Cost-Effectiveness Measures	118
	Interpretation and Utilization	121
	Summary	123
	References	125
CHAPTER IX:	SMALL GROUP WORKSHOPS FOR COST-EFFECTIVENESS ANALYSIS	127
	Guidelines for Group Workshops	127
	Results of Small Group Workshops	130

TABLE OF CONTENTS, *continued*

		PAGE
CHAPTER X:	SUMMARY AND CONCLUSIONS	137
APPENDICES		141
APPENDIX A:	PROGRAM OBJECTIVES AND TARGET GOALS	143
APPENDIX B:	HIGH SCHOOL CORPORATION (9-12th) INFORMATION HYPOTHETICAL DATA	147
APPENDIX C:	PROGRAM COST ANALYSIS FORM HYPOTHETICAL DATA	149
APPENDIX D:	ACTUAL PROGRAM OUTPUTS HYPOTHETICAL DATA	153

LIST OF TABLES

		PAGE
TABLE IV-1:	HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING OCCUPATIONAL DEMAND" CONCEPT OF VOCATIONAL EDUCATION	56
TABLE IV-2:	HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING STUDENT NEED" CONCEPT OF VOCATIONAL EDUCATION	57
TABLE IV-3:	HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING MUTUAL BENEFIT" CONCEPT OF VOCATIONAL EDUCATION	57
TABLE IV-4:	HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "MARKET SUCCESS" CONCEPT OF VOCATIONAL EDUCATION	58
TABLE IV-5:	HYPOTHETICAL EXAMPLE OF COST OF CLASSROOM INSTRUCTION IN RELATION TO JOB-RELATED PLACEMENT OF GRADUATES (AN ILLUSTRATION OF DIMINISHING RETURNS)	63
TABLE IV-6:	HYPOTHETICAL EXAMPLE OF OPPORTUNITY COSTS OF $10,000 UNITS OF CLASSROOM INSTRUCTIONAL TIME INVESTED IN THREE VOCATIONAL EDUCATION PROGRAMS (AN ILLUSTRATION OF OPPORTUNITY COSTS)	65

LIST OF TABLES, *continued*

		PAGE
TABLE V-1:	PRIORITY PROBLEMS IN IMPROVING PROGRAM EFFECTIVENESS.	86
TABLE V-2:	PRIORITY PROBLEMS IN INCREASING COST EFFICIENCY.	89
TABLE V-3:	PRIORITY PROBLEMS IN IMPROVING COST-EFFECTIVENESS OF VOCATIONAL PROGRAMS.	90
TABLE IX-1:	PROGRAM TARGET GOALS AND EFFECTIVENESS MEASURES USING HYPOTHETICAL DATA	131
TABLE IX-2:	PROGRAM EFFECTIVENESS INDICES.	133
TABLE IX-3:	PROGRAM COSTS AND EFFICIENCY INDEX BASED ON HYPOTHETICAL DATA	134
TABLE IX-4:	COST-EFFECTIVENESS RATIO AND PERFORMANCE RATIO.	135

LIST OF FIGURES

		PAGE
FIGURE IV-1:	INPUTS, PROCESS AND OUTPUTS OF VOCATIONAL EDUCATION.	61
FIGURE IV-2:	HYPOTHETICAL EXAMPLE OF RELATIONSHIP OF COST OF CLASSROOM INSTRUCTION TO JOB-RELATED PLACEMENT OF GRADUATES (AN ILLUSTRATION OF DIMINISHING RETURNS)	63
FIGURE IV-3:	HYPOTHETICAL EXAMPLE OF RELATIONSHIP OF TOTAL ANNUAL FIXED COSTS TO NUMBER OF GRADUATES PRODUCED	67
FIGURE IV-4:	HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF ANNUAL FIXED COSTS PER GRADUATE TO TOTAL NUMBER OF GRADUATES PRODUCED.	68
FIGURE IV-5:	HYPOTHETICAL EXAMPLE SHOWING POSSIBLE RELATIONSHIPS OF VARIABLE COSTS PER GRADUATE PRODUCED	69

LIST OF FIGURES, *continued*

		PAGE
FIGURE IV-6:	HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF TOTAL VARIABLE COSTS TO NUMBER OF GRADUATES PRODUCED.	69
FIGURE IV-7:	HYPOTHETICAL EXAMPLE SHOWING STEPPED RELATIONSHIP OF TOTAL COSTS TO NUMBER OF GRADUATES PRODUCED	70
FIGURE IV-8:	HYPOTHETICAL EXAMPLE SHOWING SEVERAL TYPES OF COSTS.	72
FIGURE IV-9:	HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF CLASSROOM INSTRUCTION TO WORK EXPERIENCE INSTRUCTION IN PRODUCING GRADUATES WITH JOB-RELATED PLACEMENT (AN ILLUSTRATION OF RESOURCE SUBSTITUTION).	73
FIGURE IV-10:	HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF CLASSROOM INSTRUCTION TO WORK-EXPERIENCE INSTRUCTION IN PRODUCING GRADUATES WITH JOB-RELATED PLACEMENT AND RESOURCE ALLOCATION (AN ILLUSTRATION OF RESOURCE SUBSTITUTION)	74
FIGURE IV-11:	HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF PRODUCING GRADUATES OF AGRICULTURAL MECHANICS TO GRADUATES OF AGRICULTURAL PRODUCTION (AN ILLUSTRATION OF PRODUCT SUBSTITUTION)	76
FIGURE VIII-1:	THE RELATIONSHIP OF THE FOUR CONCEPTS OF ACCOUNTABILITY, MBO, PPB, AND COST-EFFECTIVENESS ANALYSIS	117

CHAPTER I

INTRODUCTION

This handbook was developed as a product of the national priority training project #1: DEVELOPMENTAL STRATEGIES AND ANALYTICAL TECHNIQUES FOR IMPROVING THE COST-EFFECTIVENESS OF VOCATIONAL PROGRAMS. This project was conducted at Indiana University-Bloomington with financial support from the Bureau of Occupational and Adult Education, U.S. Office of Education, under the authority of the EPDA, Part F, Section 553.

The primary purpose of the project was to conduct a national training workshop and follow-up activities. The workshop programs and the participating states' follow-up activities are described in the workshop report, which is published under another cover. The objectives, development, and organization of the handbook are described below.

Objectives of the Handbook

The handbook is designed to serve as a guide for state and local administrators in developing strategies, identifying priority problems, and conducting a cost-effectiveness analysis for the evaluation and planning of vocational programs. The objectives of the handbook are:

1. To increase awareness of developmental strategies for goal-setting and resource allocation in vocational education.
2. To provide information on potential problems in improving the cost-effectiveness of vocational programs.

3. To demonstrate analytical techniques and step-by-step procedures for measuring cost-effectiveness of vocational programs.

4. To assist vocational administrators in improving management skills by using information from the cost-effectiveness analysis in the decision-making process.

Development of the Handbook

The handbook is the result of a series of cost-effectiveness study projects. Background information and the procedures used are given below.

The author and his associates conducted a research project which adapted cost-effectiveness techniques to the evaluation of secondary vocational programs. The project created a conceptual model, mathematical formulas for computing cost-effectiveness measures, data forms, and step-by-step activities for using the model. These products have been published in a Technical Report (Kim & Harris, 1976) and an Administrator's Manual (Kim, Harris, & Ruby, 1976). Further work has resulted in the development of a cost-effectiveness/benefit analysis model and Administrator's Manual for postsecondary vocational programs (Kim, 1977).

These documents enable vocational administrators to set realistic program objectives, to assess program outcomes, to determine program costs and, thus, to compute three kinds of cost-effectiveness measures: program effectiveness, cost efficiency, and cost-effectiveness and management performance ratios. They were available to the participants in the national training workshop.

In an effort to diffuse the previously developed cost-effectiveness documents, a statewide conference was conducted for vocational administrators in the state of Indiana in June, 1978. Results from the state confer-

ence, along with the cost-effectiveness reports, constituted the foundation of the national workshop on Improving Cost-Effectiveness of Vocational Programs.

The national workshop was designed to make the participants aware of cost-effectiveness strategies and techniques and train them to become change agents in their respective states. The cost-effectiveness concept was defined for training purposes as: (1) a developmental strategy, and (2) an analytical technique.

For the developmental perspective, three guest speakers were invited to present strategy papers, and the Nominal Group Technique (NGT) was applied to identify priority problems in the respective developmental strategies for improving cost-effectiveness of vocational programs. For analytical purposes, two local directors and the project director presented papers on techniques of cost-effectiveness analysis of vocational programs. After each paper was presented, small groups practiced the analytical techniques using hypothetical information and data forms.

The six papers presented at the workshop and the results of the small group activities are combined in this handbook.

Organization of the Handbook

This handbook consists of two major parts. The first part includes three developmental strategy papers (Chapters II through IV) and the results of nominal group meetings (Chapter V); the second part includes three analytical technique papers (Chapters VI through VIII) and small group workshop activities (Chapter IX). The final chapter draws conclusions.

Chapter II presents Dr. Datta's paper entitled "Inside the Black Box: Process Evaluation as a Part of Cost-Effectiveness/Benefit Analysis." The paper emphasizes the need for process evaluation and output evaluation to identify various causes of the ineffectiveness of vocational programs. Some general strategies are suggested for improving program effectiveness in vocational education.

Chapter III presents Dr. Pershing's paper: "Increasing the Cost Efficiency of Vocational Education." The paper presents an economic concept of cost efficiency and discusses its applicability to vocational education. Ideas or practices for increasing cost efficiency, problems with operationalizing the concept, and the benefits that can be derived from using it as a decision-making tool in vocational education are explored.

Chapter IV presents Dr. Copa's paper entitled "Improving Cost-Effectiveness of Vocational Programs." The paper discusses the major management decisions which affect vocational education, and alternative concepts of the purposes of vocational education. Then it suggests six economic principles which are usable as a guide for relating cost information to program effectiveness.

Chapter V describes the procedures and results of the nominal group meetings for identifying priority problems in the respective developmental strategies.

Chapters VI, VII, and VIII present a series of analytical technique papers by Mr. McKinney, Dr. Pennington, and the project director. The papers, in order, deal with: (1) "Determining Program Objectives and Outputs", (2) "Analyzing Program Costs", and (3) "Computing Cost-Effectiveness Measures for Vocational Programs." These papers provide a sequential exam-

ination of the main idea of the processes conceptualized in the Indiana cost-effectiveness analysis model developed by Kim and Harris in 1976.

Chapter IX describes the procedures used and the results of small group workshops designed to teach methods of cost-effectiveness analysis of vocational programs.

Chapter X summarizes the text and draws conclusions.

CHAPTER II

INSIDE THE BLACK BOX: PROCESS EVALUATION AS A PART OF COST-EFFECTIVENESS/BENEFIT ANALYSIS

Lois-ellin Datta*

Educational planners have long needed a practical guide to cost-effectiveness/benefit studies. While the theory of such analyses has advanced rapidly (Woodhal, 1970; Stromsdorfer, 1972a; Stromsdorfer, 1972b; Rothenberg, 1975), translating theory to practice has lagged behind in state and local planning. One barrier to the use of such analyses has been the lack of an adequate manual for data conceptualization, collection, and analysis. In large part, this barrier has been removed through the guides to cost-effectiveness/benefit analysis in secondary and post-secondary vocational education provided by Kim and his colleagues in 1976 and 1977.

The National Workshop on Improving Cost-Effectiveness of Vocational Programs is another stride toward improved information for program planning. Even the clearest of manuals require some staff preparation and guidance for prudent use. The U.S. Office of Education deserves praise for recognizing the value of federal support for national diffusion, training, and technical assistance. As states work toward fulfilling the new emphasis on data-

---

*Dr. Datta is Assistant Director, Teaching and Learning, National Institute of Education. The opinions are those of the author; endorsement by the National Institute of Education should not be inferred. Dr. Robert Harris' many contributions to correcting errors of interpretation and fact in an earlier draft are gratefully acknowledged.

based planning in the Vocational Education Amendments of 1976, cost-effectiveness/benefit analysis assuredly merits the status of a rational priority training project.

Our appreciation of these contributions may need to be tempered, however, by recognition of some missing links in present materials. Among these missing links are detailed guides to the actual use of the cost-effectiveness/benefit data for program planning and modification, a use that may require collection of data linking input to output. Simply identifying a program as ineffective or inefficient may not be sufficient to permit a judgment to be made as to how the program should be modified or deleted, or whether a new alternative program should be developed.

Engineers remind us that input/output analyses are inadequate guides to how to fix the "black box" of otherwise unspecified equipment. While the hunches of teachers and administrators about what to do to improve effectiveness are a good starting place, unless we get inside the black boxes of the programs themselves we may still be quite far from knowing how to use the cost-effectiveness/benefit data for making improvements. Indeed, without process data, it may be extraordinarily difficult to make a judgment as to how programs should be developed. Incorporating process evaluation into cost-effectiveness/benefit analysis planning could provide the otherwise missing link to sound program planning and to wise selection among strategies for improving the effectiveness of vocational education programs.

A similar view has been expressed by Stromsdorfer (1972b). In his masterful analysis of an ideal methodology for cost-benefit studies, he writes:

> The way in which the program works . . . that is, how it achieves its goals and objectives . . . must be specified. Again, this should ideally be done by the program administrators in conjunction with the researchers. In economic analysis, this specification amounts to a description of a production function -- a statement of how program inputs are interrelated and create the desired program outputs. In education we would talk in terms of educational production functions which would be ultimately based upon a theory of learning behavior. Without such a specification it is difficult to talk of cause and effect. Without such a specification one does not know how to exercise choice among the vast array of variables and functional relationships which may exist among these variables (p. 105).

Stromsdorfer notes that although authors such as Eninger (1965, 1968) develop models which contain the essence of the production function, they do not implement measurement of the function or use of these data for program modification. In 1978, these are still largely missing.

The next sections address four topics. The first section illustrates the need for process evaluation as part of cost-effectiveness/benefit studies. The second section identifies various reasons for ineffectiveness in the frequently used outcomes for cost-effectiveness/benefit analysis (enrollment, completion, employment). The third section outlines ways of getting inside the black box as part of the study planning process. And the fourth section suggests some general strategies for program improvement.

Why We Need to Get Inside the Black Box: Two Examples

The first example is hypothetical. Suppose that cost-effectiveness/benefit enrollment, completion and employment are available for three local programs: A, B, and C. While program C does creditably by internal effi-

ciency criteria, it is lowest on all three effectiveness score measures, it is last on all three weighted effectiveness score criteria, and it is last in all indicators of program effectiveness derived from the other data. We assume here that programs A, B, and C are in a fair horse race: that is, they are all trying to reach the same objectives in basically the same area (for example, tool-and-die-maker training). Also, let us assume that as program planners we want to increase the effectiveness of program C. Should the program be modified? Should it be deleted? Should an alternative program be started?

My first response, as perhaps yours, might be: Who knows? More information seems needed about the program. Suppose we are told program C runs for 12 weeks and uses the state-specified curricula for tool-and-die-maker training. What do we do to improve effectiveness? Still can't say? What else do we want to know about program C (and possibly programs A and B) before recommending changes in C or agreeing to the changes recommended by the teacher (for example, let's suppose the teacher wants to hire a teaching assistant to help the slower learners)? We might want to know something about the students: their sex, age, whether they are slow learners or fast learners in other courses, what kind of counseling they received prior to enrollment, if they were paying for the program themselves or were subsidized to stay in school, whether the equipment was up-to-date, the adequacy of the facilities, the present instructor's past record with similar students, how placement was carried out, job opportunities in the community, something of the community's placement record for similar programs, why the teacher has recommended hiring a teaching assistant over other alternatives that might have been considered, and something

about the recruitment, selection, teaching processes and placement approaches in programs A and B to see if any of the reasons for their effectiveness would be useful guides in improving the effectiveness of program C.

The actions to be taken regarding program C are not evident in the cost-effectiveness/benefit data alone. The indices are useful flags for further inquiry, yet a post hoc search for explanations before we judge what action should be taken generates more questions than are likely to be answered from data that happen to be around. And the analysis hasn't approached the next step, which would be a front-end feasibility study examining alternative solutions. Yet without such information, the planner has few ways of sorting out recommendations based on plausible explanations for ineffectiveness from recommendations which may reflect little more than self-interest, short-sightedness, or a chance to advocate what the suggester would want to do under any circumstances.

The second example of the need for process information comes from a national study of the rate of utilization of employee negotiated tuition refund plans (National Manpower Institute, 1978). The study began with a paradox. One rationale for public support of lifelong learning is a second chance for occupational development for those who missed out the first time around. Labor unions that have negotiated employee tuition refund plans have been distressed to find that the rate of worker participation often is very low. On the average, less than one-half of one percent of eligible blue collar workers participate. The younger and more educated workers have higher participation rates. The consequence is that lifelong learning under many present arrangements is increasing the gap between those with initially higher and lower levels of educational attainment. Among those advocating

public support for lifelong learning on the grounds of equity, there has been considerable interest in modifying programs to increase participation rates among unskilled and blue collar workers.

One problem in knowing what to do in this case was that no one had gone inside the black boxes of the different negotiated tuition refund plans to see the reasons for the varying participation rates. There were many hunches: for example, worker disinterest and apathy; lack of information about the plans; lack of supervisory cooperation and enthusiasm; the inability of workers to advance the costs of tuition, books, supplies and transportation; worker insecurity about ability to make the C or higher averages required for repayment in some plans; courses being given only after working hours when women workers in particular would have competing demands for child care and household work; onerous red tape to use the plans; stipends too small to reimburse true costs to workers; and courses unsuited to the interests and learning style of adults.

The National Institute of Education is supporting a study conducted by the National Manpower Institute with the endorsement of labor unions and management to find out why the utilization rates are generally low, yet vary from plan to plan. The first phase of the study has had two parts. The first part is an examination of the features of the plans and the localities in which they are being operated; for example, plans with and without advance payment features, plans with and without the C grade or better requirement, localities where opportunities for mobility if further training is obtained are abundant, and sites where the worker would have to move to obtain a better job. The second part of the first phase has been an investigation of what shop stewards and other union officials

think the reasons are for varied participation rates, contrasted with the reasons given by eligible workers and by management in firms with high and low participation rates. The product of the first phase will be an identification of the most plausible reasons for variation in participation rates. During the second phase, representatives of labor unions and management will indicate which reasons might most feasibly be changed. As an example, giving all workers a five year fully-paid sabbatical with no loss of seniority or benefits might improve participation rates considerably but not be feasible enough to be worth testing. Reducing red tape, providing good information and paying front-end costs for all aspects of education so workers would not have to use their own monies on the hope of later payback might be feasible enough to merit further examination.

During the second phase, explanations selected as plausible and feasible will be tested experimentally in a large number of cooperating plants. The effects of these changes on worker participation and on other aspects of concern such as increased productivity and improved morale will be studied. Findings from this experiment are being anticipated by educational planners, labor unions and management as a useful source of information on what to do to improve worker participation in the negotiated plans. The experimental results may be a more reliable basis for action than the often conflicting hunches offered during discussions of the initial effectiveness data.

In both the examples, considerable time would be required between examining the effectiveness data and judging what to do to improve effectiveness, because information relevant to alternative courses of action was not collected from the beginning as part of the program. In the first

example, the data are hypothetical. In the second example, planners were so sure that workers would participate at high rates that they did not build in any process or outcome evaluations when the plans were first negotiated. We are now having to backtrack where some planning ahead for process studies might have prevented considerable present uncertainty about how to improve program effectiveness.

Understanding the Data: Some Possible Reasons for Ineffective Programs

This section considers the numerator of effectiveness/cost ratios and looks at only three measures of effectiveness: enrollment, completion and employment. These outcomes have been selected to illustrate alternative reasons for ineffectiveness, because they may be among the foci of this training session. It cannot be emphasized too strongly, however, that many other outcomes of vocational education programs may be selected as criteria of effectiveness. Educational outcomes are something of a vast cafeteria from which program planners, teachers, and other stakeholders can choose what they want to hold their programs accountable for achieving. Emphasizing stakeholder participation in establishing criteria can help keep our educational thinking flexible, and can also help keep programs closer to the changing needs of individuals and of society. For these other outcomes (for example, completing school, academic achievement, improved motivation as indicated by higher attendance rates, personal satisfaction with training, the attraction of industry to the area through the pool of skilled labor), possible reasons for ineffectiveness other than the reasons discussed next would need to be explored.

One explanation would hold, of course, for almost any type of outcome. Particularly where effectiveness is defined as the ratio of achievement to expectation or to initially established goals, high effectiveness could be an artifact of levels of expectation set too low to be meaningful, while ineffectiveness could be due to setting initial levels of expectation too high. While defining effectiveness as the ratio of achievement to aspiration (or actual versus expected levels, or achieved versus predicted levels) can be an important step forward in evaluation intended to improve local programs. It also carries with it a requirement for very great attention as to how levels of expected achievement are established. A discussion of factors to consider in setting levels of expectation for both costs and effectiveness would require another paper and will not be dealt with here. It is important to keep in mind, however, that the first step in understanding the reasons for either high or low effectiveness indices may be to examine the way in which the expectations were derived. These should be meaningful to the many stakeholders in vocational education, including but not limited to, the teacher and the program director.

Enrollment

Turning first to enrollment: suppose a goal of a program was a level of enrollment in a vocational education class representative, in terms of gender, of the eligible school population, and that the effectiveness ratio (achievement divided by expectation) was .70. What modifications would improve program effectiveness? Among the possible reasons for the less-than-perfect effectiveness ratio might be:

Lack of Information. Information about the program was not available equally to men and women. Perhaps most students enroll in a course primarily

through word-of-mouth from other students. If earlier courses had sex-biased enrollment, the informal network would be sex-biased itself, and an assertive outreach program might be needed to bring information equally to both sexes.

Differences in the Course Value. The course value might seem differentially attractive to men and women. Perhaps the course is seen as one in which students of different sex would have differential failure rates (for example, 50 percent of the girls -- all two of them -- who take automotive mechanics may have failed in the past). Students may believe the content would be useful only to one gender (for example, a belief that men don't need home economics), or feel that the teaching situation would be congenial only to one sex. The value of the course would need to be equal if equal enrollments were expected.

Lack of Parents' or Spouses' Support for Student Enrollment. Parents are cited by the students themselves as the single most important influence on their choice of high school courses. Among post-secondary students, spouses are cited as the most influential. If these influential others discourage enrollment, outreach to the students alone would be insufficient to change gender distributions.

Enrollment -- First-Come, First-Served. Some courses may be chronically over-enrolled and selection may be made on a first-come, first-served basis. Students considering enrollment in non-traditional courses may be last to enroll. Changing the selection criteria, urging early enrollment or opening more sections may be necessary in this case if effectiveness on the enrollment criterion is to increase.

Inconveniences in Enrollment. The time, costs, or location are convenient only to one gender. A welding course given in the evening in an inaccessible site with poor public transportation and badly lighted streets might not attract many women. A course in parenthood education given in the middle of the day in a maternity hospital child-care center might not attract many young men.

Discouraging Instructor or Counselor's Attitudes. Students may discuss programs with counselors or instructors prior to enrolling. While many instructors or counselors may encourage students to explore nontraditional courses, there are still many others who will directly and subtly discourage students from trying out nontraditional areas.

Needs for More Pro-Active Counseling. If a woman wants to enroll in an office practices course, does the advisor provide information about wages, benefits and working conditions in other areas such as skilled trades? If a man enrolls in truck driver training, does the advisor discuss the stresses the work conditions place on family life and help the man consider opportunities in fields such as paralegal work or social service delivery? To many counselors, sex-fair counseling means little more than not prohibiting enrollments. If a program wants to increase effectiveness in gender-fair enrollments, finding out whether counselors are pro-active, neutral, or reactionary might be a valuable guide to improvements.

Differences in Progress. Rate of change is already high even if absolute level is less than 100 percent. Perhaps the rate of change in sex-fair enrollment seen from a five year perspective indicates that at present rates, enrollment will be sex fair in three years if the program does nothing except to continue whatever it has been doing right. While inadequate pro-

gress cannot be excused if achieving sex-fair enrollment is a program objective, sometimes modifications slow down rather than maintain or speed up satisfactory rates of progress.

This brief hypothetical example suggests the diversity of reasons for a less-than-perfect effectiveness ratio on enrollment. The cost, effort, and feasibility of program changes based on one explanation (for example, the time/location explanation) might differ considerably from the cost, effort, and feasibility of modifying enrollment rates if the primary reason is spouse or parent resistance. The effectiveness figures alone are an inadequate guide to what to do next. Particularly where different actions would seem appropriate for different explanations, cost-effectiveness/benefit analysis needs evaluation of educational process and production functions as part of planning.

Completion

As a second example, suppose the completion rate of a course was lower than desired. Among the alternative explanations might be:

Learners' Goal Achievement. Learners might be scheduled for a 12 month program, but many of the noncompleters might have learned enough in six months to meet their own objectives, such as adequate information for informed consumerism or enough training to enter full-time employment. Clues to this explanation include finding out that most drop-outs left at the mid-point of the course, that many left to take full-time employment in a related job, and that many reported that the course satisfied their own goals at time of enrollment.

Difference Between the Prospectus and the Content. Learners found that the prospectus and the content differed. A student signing up for an

architecture course to obtain some practical information on home layout who found the course was mostly built around drafting techniques and building standards might well drop-out. High rates of noncompletion after a week or so in the program might point to misinformation about the nature of the course. Learners might sensibly switch rather than waste their time and money.

Different Expectations. The primary reasons for enrollment were to qualify for other benefits. Some learners may never have been bona fide students. They may have enrolled only to qualify under certain public laws for other benefits and have dropped out as soon as they had been enrolled long enough to qualify for these benefits.

Poor Teaching. Teaching may have been poorly suited to the learners. Not all teachers are as skilled or diligent as they should be, and not all skilled, diligent teachers can adapt their teaching style to the needs of diverse learners. Poor instruction might be a reason for high noncompletion rates.

Inadequate Equipment and Facilities. Over-crowded facilities which did not permit students to have adequate use of equipment (for example, only one of the expensive new word-processors in an advanced secretarial class), obsolete equipment, or facilities unconducive to learning could account for high drop-out rates. While excellent facilities do not in themselves the excellent program make, adequate learning with inadequate facilities may be difficult to achieve.

Poor Administration. The course may be part of a larger program or school which is poorly administered. Suppose the completion ratios of live-stock production programs were being compared across a state and one program

was clearly very low in completion rates. The program might be embedded in a school with such poor administration and management that all courses have low completion levels. The secondary school principal is emerging as the single most important factor in both safe and effective schools. The course itself might have no room for improvement, but it might be part of a school in which the principal was an unskilled manager.

Lack of Funds or Presence of Family Pressures. Among girls, pregnancy is the single most frequent cause of dropping out of secondary school. Among boys, particularly in low-income areas, lack of money to continue in school and poor general achievement are linked as reasons for noncompletion. The course itself might have little to do with retention or completion; availability of other services for learners might be crucial in some situations if retention rates are to improve.

Selective Retention. Selective retention may suggest ways to increase completion: are the noncompleters the brightest students at time of enrollment? The less able students? Knowing who drops out can be a readily obtainable and useful guide to program modifications.

Knowing what to change to improve retention requires considerable examination of the reasons for nonretention. Again, the courses of action suggested by finding out completion is very low for all programs in a given school, by discovering that most noncompleters are leaving because their own goals have been very satisfactorily fulfilled, or knowing that almost all drop-outs were never bona fide students, would lead in considerably different directions for program deletion or expansion. Process studies of what is happening within the program together with information on effectiveness would be better guides for action than effectiveness data alone.

Employment

As a third and last example, suppose the program being reviewed had high placement rates. Would this mean the program should be expanded? This example is given lest it be assumed that only low effectiveness rates need to be examined. In program planning and decision-making, as this section may illustrate, knowing what apparent success indicates can be as important as considering alternative reasons for ineffectiveness. Among the reasons for the high placement rates in this hypothetical program might be:

An Unprecedented, One-Time Expansion of the Job Market. It's usual that when there are more jobs than skilled personnel, more people are employed up to the point where so many people are attracted into the labor market by availability of work that the rate of job creation is out-stripped by rate of entry into the work force. High employment rates could be due to a sudden increase in job availability (for example, the rapid job creation associated with construction of the Washington, D.C. METRO system).

An Assertive Placement System. High employment rates could be due to an aggressive placement system for that program which gets its graduates first in line for the relatively few jobs available in the community. If all local programs were equally assertive, the placement rates would drop for the apparently effective program.

Low Competition. Is the program the only source of workers for the field? Perhaps other local schools offering similar training have closed, or the area was becoming unattractive for in-migration. The high employment effectiveness ratios might be a by-product of the employers' willingness to hire almost anyone.

No Preferred Alternatives to Employment. High employment rates among program graduates might be due to the low attractiveness of other alternatives. Loss of subsidies for not entering the labor market, for example, or shifting the attractiveness of payment for not working versus employment through increases in the minimum wages or decrease in welfare payments could increase willingness to work. Changes in policy regarding the family, the acceptability of part-time work, enthusiasm for return to full-time schooling, or unemployment compensation differentials could affect employment rates independent of the program's intrinsic merit. While data are usually protected against these variables by referring to employment rates among those program graduates who wish to work, other data may refer only to employment rates among all program completers.

Excellent Training. Excellent technical training may be the basic reason for high effectiveness ratios on employment. This is usually the first explanation of high effectiveness on employment criteria and is included as a reminder that the program may just be doing an outstanding job of developing work skills where these are required for job entry.

Graduates' Desirable Worker Habits. The program may have been responsible for developing good inter-personal skills, excellent work habits, a sense of responsibility, good communications skills and other personal habits sought by employers.

Selective Applicants. Applicants are selected to be highly employable. High levels of effectiveness on the criterion of employment may be due to selection into the program of individuals who under almost any circumstances would be offered work and would be likely to keep it. Some programs with low effectiveness on employment may be serving an applicant pool which is hard to employ even with adequate skills and training.

Good Working Conditions. Employers may be offering highly desirable working conditions. Employers in an area may be offering such enlightened working conditions that employees are unlikely to leave the company once they are hired. Such excellent conditions may boost employment rates by having fewer people between positions than do equally good programs serving learners in areas where employers are less enlightened.

The third example, chosen to illustrate the need for process information before expanding an apparently successful program, also has implications for action alternatives. The program which has succeeded in providing superior skills or attitudes may be the one to expand, providing it is feasible to do so and that effectiveness would not be reduced were the program offered on a larger scale. Expansion of a program reporting high employment ratios which are attributable to local employer enlightenment or to selection of only highly employable trainees might make less sense.

A practical illustration of this principle is found in Somers (1971). He reports that the effectiveness of vocational education (as measured by employment, wages and earnings three years after graduation) was greatest for junior college graduates and lowest for graduates of high school vocational programs. Since costs were fairly similar, the cost/benefit ratios clearly favored junior college programs. However, Somers also reports that the programs drew from differing populations of students, with junior college entrants being predominately males and coming from families with higher socio-economic status. Somers' analyses showed that independent of program, socio-economic status and sex affect the pay-off of vocational education, with men and students from more advantaged backgrounds doing better in the employment outcomes studied for programs located in junior colleges, post-secondary

schools, or high schools. Expansion of only the junior colleges would result in lower numbers of lower income groups and of women participating in vocational education, if no other changes were made in recruitment, selection, or other factors influencing enrollment and completion at junior college levels.

These three examples illustrate alternative explanations of what is happening to cause programs to vary in effectiveness. They are intended to show that knowing the reasons for the variation in effectiveness should influence what alternatives are considered with regard to modifying, deleting or initiating new programs. With a systematic effort to identify alternative reasons, and to collect information related to them, cost-effectiveness/benefit analysis may be an even more useful guide to wise action regarding the program. The next section examines ways of getting inside the black box.

Finding Out:
Planning for Program Information

Under ideal circumstances, program planners working with program staff and administrators could predict alternative explanations for high and low effectiveness ratios. They would arrange to collect data to inform the planning and operational group which of these explanations seem most plausible. And they would continue in follow-through sessions, after the effectiveness data have been reported, to use postdictive and convergent techniques to determine the most probable reasons for the findings.

We have just gone together through an exercise in postdiction, looking at three measures of effectiveness and listing hunches about alternative reasons for the findings. Checking out some of the hunches would

require only analysis of data probably available with slight additional effort: for example, comparison of completion rates for high and low achieving students or examination of pre-program employability of the applicant pool. Other hunches would have required simultaneous data collection: for example, observations in the classroom of instructor teaching style, observations of the facilities and equipment, information on course announcements and descriptions, or documentation of changes in the supply side due to closing or expansion of other sources of vocational graduates. Still other hunches would need retrospective data collection: for example, follow-up studies of noncompleters to find out which ones left because their learning objectives had been satisfactorily completed, or an assessment of on-the-job competencies and attitudes of program graduates.

During the next few years, many vocational education programs will have fairly extensive process evaluations through participation in the National Vocational Education Data System and through collection of the data provisionally required for the state in in-depth reviews. These data could form an excellent core for process evaluations. Through planning ahead, information to check out plausible hunches could be efficiently obtained. It is much easier, for example, to collect data on student grade point average at the time of application, if this will be needed for one analysis, than tracking back through school records to obtain GPAs of completers and noncompleters 12 months or more after the class is over. If detailed information on facilities and equipment is needed, it is easier to attach a supplemental form to the basic reporting record of employment, completions, and enrollments, or to request this information from planned state site visits, than it is to ask someone to recreate what a classroom might have been like

6 to 12 months before. If a follow-up study or exit interview is needed for noncompleters, it is easier to construct a brief interview form at the time the cost-effectiveness/benefit study is planned, making this available with enrollment forms, than to do it perhaps two years after the student has dropped out.

It may be argued that there are too large a number of explanations to handle in a predictive study or in tailoring a process evaluation for each program. This argument might hold that planning multiple-correlations of most likely explanations with effectiveness ratios would be simpler than tailoring each black-box analysis to each program, or that informed hunches are cheaper and just as effective as black-box studies.

These are important objectives, and there is little evidence ruling them out. In fact, there is little evidence at all about generation of alternative courses of action and how to reduce large numbers of hunches to a much smaller number prior to a cost-effectiveness/benefit process study. Most planning manuals in vocational education are written at high levels of generality and abstractness such as, "Use the data to develop short-range plans for improvement. Use the data to develop long-range plans for improvement." I have found very few case studies illustrating even a single program modification, deletion, or expansion, or at least not a case study describing how alternative courses of action were generated, what alternatives were considered, how the eventual course of action was selected, and whether the change resulted in an improvement.

To a certain extent, then, we are guided here more by faith than by experience. I cannot cite to you references proving that the effort required to include black-box studies with cost-effectiveness data will be

better than intuition, political realities, popularity, informed hunches, or whatever is currently used to go from effectiveness ratios to actions. But I hope the examples may have been somewhat persuasive.

Turning now to the last question: What are some broader strategies for improving the effectiveness of vocational education programs? Although intrablack-box analyses are needed, four approaches to program improvement can be identified.

Strategies for Improving Vocational Program Effectiveness

There are four general strategies for improving effectiveness. These are: (1) changing the nature of the population served, (2) changing the program, (3) changing the environment of which the program is part, and (4) leaving it alone. The next sections consider each of these at somewhat greater length.

Different Students. Not all programs can be everything to everyone. Most programs are very effective for some students, moderately effective for others, and ineffective for some. These students usually are fairly identifiable from analyses of outcome data. If it is not possible to substantially modify either the program or the situation, one strategy for improving effectiveness is to focus on the students which the program in its present form best serves. As an example, suppose a program apparently is not effective for students with multiple personal problems, for students involved heavily in drugs or alcoholism, or for students who are of National Merit calibre. One way to improve the effectiveness of this program might be to provide prospective students with the fullest information about which ones probably

will not do well in the program, or to select students to maximize effectiveness. There is little wrong with this approach as long as personal characteristics such as gender, ethnicity, or handicapping condition are not used as direct or indirect screening devices. If alternative programs of greater effectiveness for students who should be screened out are available, the selective recruitment could improve efficiency as well as effectiveness.

Another approach to the "different students" strategy of improving effectiveness is greater cooperation of vocational education programs with feeder schools. If lack of prerequisite training in spatial skills, for example, is a primary reason for low program effectiveness on some criterion, the vocational education program could take the initiative in letting feeder schools know of this need and in helping the feeder schools increase the pool of applicants who can be served by the program. Particularly for achieving equality of opportunity, proactive efforts on the part of the vocational education programs to help improve the skills of the entry-level pool of applicants could be a more effective strategy for improving program effectiveness than varying instructors or curricula after remediation is needed.

Changing the Program. Changes to the program could include varying access, content, and process. Greater effectiveness on criteria such as enrollment might come from changing when the program was offered (time of the day, frequency, and time of the year), where the program is offered (dispersed versus more centralized location; on-site or within a school), and the tuition or other financial requirements of the program. Increased access also includes changes in outreach, counseling procedures and informa-

tion for prospective students and their families. As an example, many colleges are offering mini-courses, some of which provide academic credit, for family vocations. Learning networks, using community resources to link learners and instructors, per Illich, are spreading. Alternate uses for empty primary school buildings have included opening neighborhood learning centers.

Changes in the content of the program have included deletion of entire courses (for example, the decision of an area vocational-technical school not to offer any more cosmetology courses on the basis that the market was saturated) and addition of new programs (for example, in small business management and in light aircraft maintenance and repair). Other changes could include modification of components, course duration, criteria of acceptable progress and completion, procedures for placement and follow-up, and relative emphasis on skills versus attitudes.

Changes in the teaching/learning process have been popular. Comparison of the strategies at secondary and post-secondary levels suggests quite differing beliefs about the best way to improve teacher effectiveness. At the secondary level, state requirements, teacher unions, and schools of teacher education combine to limit considerably who can be hired to teach. Requirements for having earned one's living in the vocational subject taught are often minimal; requirements for completion of process-oriented courses are sometimes maximal. At the post-secondary level, there are few state requirements and few situations involving negotiated labor/mangement contracts. Few schools of teacher education prepare professors of physics, engineering, or political science. At the post-secondary level, content and experience are assumed more important than teaching process training, and requirements

for having earned one's living in the vocational subject taught are correspondingly greater. Since few educational planners can directly influence certification requirements or union agreements, the strategies to improve the teaching/learning process often emphasize training at the secondary level and recruitment/selection at the post-secondary level.

Changing the Environment. Changing the environment is a little used strategy, yet it may yield considerable return in improving effectiveness on some criteria. A large proportion of student drop-outs, for example, are due to economic and social service needs beyond what an individual teacher can be expected to meet. Cooperation among community service agencies, employers, and labor unions to improve human resources support, the preparation offered by the school, and the climate on the work place are among the new directions in vocational education. The national response to the idea of education-and-work councils suggests that many see considerable hope for change through a mechanism that emphasizes change in the work place and the community. A great deal of youth unemployment is due to job switching -- voluntary job changing. Attention by vocational educators to modifications in the work place making job-keeping more attractive (for example, smaller and more rapid steps in upward mobility within a firm, assurance that an entry-level job isn't a dead-end job in the company, improved working conditions and supervisor attitudes) could have substantial payoffs in improved program effectiveness where employment is among the criteria.

Leaving the Program Alone. The last strategy -- leave the program alone -- may be most attractive in three circumstances. The first is where, imperfect as the program is, there are no alternatives which are feasible,

and it is not reasonably clear why the proposed modifications should be expected to improve effectiveness. The second instance is where progress is being made at an acceptable rate. The third circumstance is where the probable increase in effectiveness, relative to the effort required, is low. As an example, a program serving a high risk population might be able to increase retention ratios from 50 percent to 55 percent by considerable effort, but the 5 percent increase may be a relatively unattractive investment, particularly if the reason for the low retention rate is primarily circumstances beyond the program's control.

In summary, these four broad strategies (different students, different curriculum, changing the environment, leaving the program alone) may be useful categories for thinking about development of alternatives. They are, however, only a quite open framework into which the detailed process information for each program might fit. The best answers to improved effectiveness rest in greater understanding of what inside the black box of individual state and local program operations influences the measures of effectiveness selected. Data from students, staff, administrators, site visitors, and vocational education directors of other programs are among the many resources available for assuring that the hard-earned results of the very thoughtfully developed new approaches to cost-effectiveness/benefit analysis can indeed become a powerful, well-used tool for managers, teachers, and the public for improving program effectiveness.

REFERENCES

Eninger, M. U. *The process and product of T & I high school level vocational education in the United States: The product.* Pittsburgh, PA: American Institutes for Research, AIR-D71-1 9/65-FR, September 1965.

Eninger, M. U. *The process and product of T & I high school level vocational education in the United States: The process variable.* Pittsburgh, PA: Educational Systems Research Institute, 1968.

Kim, J. E., & Harris, R. C. *A cost-effectiveness analysis model for secondary vocational programs: Technical report.* Bloomington, IN: Indiana University, 1976.

Kim, J. E., Harris, R. C., & Ruby, D. D. *Cost-effectiveness analysis of secondary vocational programs: Administrator's manual.* Bloomington, IN: Indiana University, 1976.

Kim, J. E. *Cost-effectiveness/benefit analysis of post-secondary vocational programs: Administrator's manual.* Bloomington, IN: Indiana University, 1977a.

Kim, J. E. *A cost-effectiveness/benefit analysis model for post-secondary vocational programs: Technical report.* Bloomington, IN: Indiana University, 1977b.

National Manpower Institute. *A study of negotiated tuition aid in industry.* Washington, DC: National Manpower Institute, January 1978.

Rothenberg, J. Cost-benefit analysis: A methodological exposition. In E. L. Struening & M. Guttentag (Eds.), *Handbook of evaluation research.* Beverly Hills, CA: Sage, 1975.

Somers, G. G. *The effectiveness of vocational and technical programs: A national follow-up survey.* Washington, DC: Department of Health, Education and Welfare, 1971.

Stromsdorfer, E. W. *Policy issues and analytical problems in evaluating vocational education* (Vol. II). Washington, DC: National Planning Association, Center for Priority Analyses, October 1972a.

Stromsdorfer, E. W. *Review and synthesis of cost-effectiveness studies of vocational and technical education.* Columbus, OH: The Center for Vocational Education, August 1972b.

Woodhal, M. *Cost-benefit analysis in educational planning.* Paris: International Institute of Educational Planning, 1970.

CHAPTER III

INCREASING THE COST EFFICIENCY OF VOCATIONAL EDUCATION

James A. Pershing*

I have the responsibility of sharing with you several ideas dealing with increasing the cost efficiency of vocational education. I shall proceed in the following manner. First, I will spend time in developing an understanding of the concept of cost efficiency. Then I will discuss the applicability of the concept to vocational education. Several problems and concerns with operationalizing the concept will then be explored as well as the benefits that can be derived from using it as a decision-making tool in vocational education. I will conclude with some remarks regarding the status of vocational education planning and evaluation in general.

Prologue to Understanding Cost Efficiency

In order to fully understand the usefulness and limitations of cost efficiency analysis, it is necessary to familiarize ourselves with the discipline that spawned the concept. Cost efficiency comes primarily from the domain of the economist. So, let us proceed to establish some background information regarding the purpose and usefulness of the discipline of economics.

---

*Dr. Pershing is an Assistant Professor in the Department of Vocational Education at Indiana University-Bloomington.

In simplest terms, economics is concerned with the best way of allocating scarce resources among various uses to make some individual or group as well off as possible. Obviously, society does not have enough resources to produce all the goods and services that everyone wants. For this reason, choices must be made regarding what to produce. The intricacies of determining what goods and services to produce and how best to allocate society's resources to their production are what concerns economists (Lumsden, Attiyeh, & Bland, 1970, pp. 7-8).

It is important to understand that the theories and principles that economists set forth to explain these occurrences are methods rather than doctrines. Economics is an apparatus of the mind, a technique of thinking. Its purpose is to help its possessor draw correct conclusions. If we embed in our minds these thoughts regarding economics, then we will be less likely to misuse or abuse its concepts and tools of analysis (Martin & Miller, 1961, p. 1).

Microeconomic Theory

Cost efficiency analysis is, or least should be, the application of certain principles of microeconomics to actual problems of decision making. Microeconomics is concerned with the behavior of specific economic units. When operating at this level of analysis, the economist is concerned with the details of operation of a very small segment of the economy such as an individual industry, a firm, a unit of government, or even a household. In microeconomics it can be said that we examine the trees rather than the forest (McConnell, 1963, p. 16).

Microeconomics constitutes the theoretical base for cost efficiency analysis. Whatever is said about the concept of cost efficiency should be

merely a restatement of some basic notion of microeconomic theory. To proceed otherwise would be to ignore the principles of scientific analysis and to negate the value and usefulness of one's work.

The Paradigm of Choice

Problems of decision making are usually viewed as those of constrained maximization or minimization. In other words, the problem is to choose among feasible alternatives so as to achieve most of what is desired with given quantities of resources, or to acquire given quantities of what is desired while using the fewest possible resources. Such problems of choice entail a number of aspects which deserve attention.

First, an objective function must be specified. It makes little sense to try and maximize output or minimize input without first clarifying the goals of production. In other words, objectives must be determined by decision makers. The products which are deemed desirable must be enumerated and statements regarding production targets must be formulated.

Second, constraints must be determined. Choices that are preferred must be possible to achieve. We can all think of highly desirable production goals that are simply not feasible. In most instances, nonfeasible alternatives are determined by constraints. Some important kinds of constraints include technological constraints, policy constraints, socio-political constraints, legal constraints, and of course resource constraints.

Sometimes, alternatives are deemed nonfeasible for reasons other than constraints. For instance, alternatives that entail variables that the decision maker can neither control or manipulate are often considered as nonfeasible alternatives. The decision maker, when elaborating upon feasible

alternatives, will often give higher priority to those alternatives that entail more variables that can be controlled and manipulated.

Finally, feasible alternatives must be evaluated and choices made. The work of the decision maker would be simple if we had a world of perfect certainty and alternatives that were mutually exclusive. However, reality yields a world of uncertainty, alternatives which can be complimentary or substitutable, and budgetary constraints which are not always independent from alternative choices (Judy, 1969, pp. 16-19).

Defining Efficiency

An important question that must be answered before we can proceed is the meaning of the term efficiency. One kind of efficiency is technological efficiency. For instance, if a firm produces a given output and uses up the smallest possible quantity of resources in doing so, then it is technologically efficient. Put in a cost context, the firm would incur the least possible cost in producing a given output. Clearly then, if a firm seeks to maximize profit, it will be in its own best interest to reduce costs by becoming technologically efficient (Lumsden, et al., 1970, p. 235).

Another kind of efficiency is economic efficiency. Unlike technological efficiency, where the problem is simply one of obtaining maximum ouput from each unit of resources, economic efficiency is defined relative to the wants of consumers. In this case, the problem of the firm becomes one of producing at the lowest possible cost that which consumers will buy. In this context, efficiency of resource use is defined in light of that which will maximize the wants or utility of the consumer (Martin, et al., 1961, p. 35). So, for a firm to be economically efficient, it must be

technologically efficient and in tune with the wants of the consumers it seeks to serve.

Defining Costs

The production of any good or service requires the use of scarce resources. A basic fact that cannot be ignored is that scarce resources have alternative uses. Therefore, the real cost of using a resource entails the benefits that could be realized by using the resource for an alternative purpose. Such costs, called opportunity costs, are often difficult to measure in monetary terms.

The kinds of costs that are measurable fall into two broad categories. The first, explicit costs, consist of those money payments made to outsiders who provide the labor, materials, power, transportation, and so forth that are required to produce and market a product. The second, implicit costs, are those costs assigned to resources which are owned by the producer and used in production. The reasoning behind implicit costs is simple. There is a cost involved in using a resource whether it is owned or purchased. For instance, the proprietor of a corner grocery store, who owns the building, does not have free rent. The money that could be earned by renting the building to another proprietor, for example, is an implicit cost of the operation (McConnell, 1963, pp. 433-434).

Cost Efficiency

Now that we have some understanding of the concepts of efficiency and cost as used by economists, let us put the concepts together. In short, to be cost efficient implies that a particular level of performance is achieved using the fewest possible resources. Cost efficiency appears to be a rather

straightforward and simple concept. However, when one attempts to operationalize and thus use the concept, a variety of complexities set in.

Cost Efficiency and Vocational Education

Perhaps the best way to proceed in discussing cost efficiency and vocational education is to employ what is called the general systems approach. Vocational education, as a phenomenon consisting of a number of interacting entities that form a whole, can be thought of as a system. The basic structure of any system will include elements that can be classified as inputs, outputs, and processors. Generally, inputs are anything taken into the system, outputs are anything generated outward from the system, and processors are mechanisms that convert input to output. When outputs are used to alter inputs or processors they are called feedback. External surroundings or circumstances that may influence inputs, processors, or outputs constitute the system's environment (Pershing & Elbert, 1975, pp. 4-5).

By utilizing the systems perspective we can see that a price tag, cost, or value can be attached to vocational education inputs. Also, it becomes clear that concerns related to making the system technologically efficient can be focused on the vocational education process. And finally, the goals and objectives of vocational education can be translated into desirable outputs which the system is to generate. Thus, to increase the cost efficiency of vocational education programs, the analyst must first be concerned with clarifying the goals and objectives of the system. Then, in light of this information, one of two steps may be taken to increase the cost efficiency of the system. First, inputs to the system may be decreased while holding outputs constant. Or, output may be increased while holding inputs constant.

Vocational Education Outputs

It is ludicrous to concern oneself with the cost efficiency of vocational education without first enumerating its objectives. For, if the objectives of vocational education are not met, the system fails. So, we must ask, exactly what is it that vocational education is attempting to maximize or minimize?

As most of us know, federal vocational education legislation indicates that youth and adults are to have ready access to vocational training or retraining which is realistic in the light of actual or anticipated opportunities for gainful employment. This training is to be suited to their needs, interests, and ability to benefit from it. The legislation addresses extending and improving current programs and developing new programs. Efforts are to be made to overcome sex discrimination and sex stereotyping in vocational education programs. Special provisions are made for those with special educational handicaps and those in postsecondary schools. And, all of this is to be planned for with the involvement of a wide range of agencies and individuals concerned with education and training in each of the states (Vocational Education Amendments, 1976).

By scrutinizing the federal legislation as well as the historical practices and mores of vocational education, one is able to conjure up numerous goals for vocational education. A few of the many include the following:

1. to increase the number of students served;
2. to decrease the number of dropouts from the program;
3. to increase the training-related-placements of program completers;
4. to increase the number of program completers;

5. to increase the number of students continuing education after completing the program;

6. to increase the labor force participation of program completers;

7. to meet the vocational interests of students;

8. to decrease program costs;

9. to increase enrollments of males or females, as appropriate, in traditionally sex biased programs;

10. and, to increase the number of students served from disadvantaged families (Atteberry, Miller, & Pershing, 1977, pp. 57-63).

As can be seen from this all too typical listing of vocational education program goals, numerous problems exist for the cost efficiency analyst if such goals are all that exist to work with. In such instances, certain determinations must be made before analysis can begin.

First and foremost, the unit of production for vocational education must be agreed upon. In most instances this can be reduced to the student. However, what we might refer to as the "make" or "model" of the student is another matter. For this reason, the qualities or attributes the student should possess must be determined. The qualities or attributes must be labeled as those the student is to possess before entering the vocational education program and those that are to be imparted by the program.

In reality, before the "make" or "model" of the student the vocational education system is to produce can be determined, market research must be done. In vocational education we call this "needs analysis." The needs vocational education seeks to meet are at best bi-dimensional. The first need is most often classified as a people need. Those youth that have trouble bridging the gap between the world of school and the world of work are of prime concern, as are those adults who have labor market difficulties.

These individuals must be enumerated on the basis of socioeconomic and educational characteristics and placed in needs categories.

Once people's needs are known, the second step towards determining vocational education's product line is to ascertain labor market needs, or to put it more aptly, labor market opportunities. For, once vocational education's product enters the labor market, it only makes sense to maximize its employability. This involves matching vocational education's potential products with potentially gainful employment opportunities.

The final step in determining vocational education objectives is to translate the people and labor market needs that have been interfaced into vocational education programs and support services. Decisions regarding program levels as well as the most appropriate delivery system must be made in light of needs. Programs, which constitute courses, and courses, which constitute units of study, must be determined for each needed vocational education product line. From these decisions will flow vocational education's targets for production.

Vocational Education Inputs

Vocational education inputs can be classified in numerous ways. For clarity and brevity let us use three classification schemes.

The "raw material" of vocational education, the student, is the first classification. Unlike the raw materials often used in business and industry, students are neither consistent in their physical attributes nor consistent in the way in which they will react to processing. Hence, we have a heterogeneous input. Obviously, this creates numerous problems in aggregating the input we call "student."

The problems created by the student input variable are very similar for the second classification of inputs which is professional personnel. Teachers, administrators, and support personnel are not homogeneous inputs. Of no great surprise is the fact that some teachers are more knowledgeable than others, some administrators supervise and plan more effectively than others, and some support personnel are more talented than others. These problems would be of little consequence if we knew how to describe and recognize a good school teacher or school administrator. If we had such capabilities, all professional educators could then be categorized in light of their effectiveness as an input variable.

The third input classification falls under the broad category of buildings, equipment, and supplies. Here, the input list is long, but more easily quantified. A price tag can be affixed and units of measure determined. However, in many of our schools, record keeping systems make this task a nightmare.

Despite the inherent problems of determining units of measure and assigning costs to vocational education's inputs, several ideas for decreasing the costs of these inputs or, just as importantly, improving their quality come to mind:

- With regards to buildings, equipment, and supplies, the first question that needs to be asked is, are we being wasteful? The second question is, are we getting the best deal we can when we purchase these inputs? In other words, have we shopped around and sought the best price possible? If these questions cannot be answered with a yes, the vocational education administrator may have work that is unattended.

- With regard to the input categorized as professional personnel, savings of a sort can be realized. First, years of experience, and credentialization in excess of the minimum are expensive. Be certain that such

attributes are more than just luxuries. Second, devise systematic means and measures, even though they may lack precision, to assist in employing the best professional personnel available at the going wage rate. And third, consider investing in on-the-job training for professional personnel. It is usually good business to improve one's "fixed resources."

- With regard to the raw material I have labeled "students", some improvements can be made. First, there is a payoff in making certain that the input student is accurately classified and categorized. This will lead to more efficient use of the input. Second, it is beneficial to be certain that the input student is a willing and enthusiastic participant in vocational education. Adequate counseling and pre-vocational experience can assist in this endeavor.

Rather than dwell any longer on improving vocational education's inputs, I will let the ideas presented be food for thought and let you think of other possibilities.

Vocational Education Processors

In industry, the job of increasing the efficiency of the manufacturing process falls primarily on the engineer. In education, the job falls primarily in the domain of the curriculum and instruction specialist. All educators have some knowledge about and much interest in improving the instructional process, but the real burden for developing and testing innovations in this area belong to the curriculum and instruction research and development specialist.

Any idea or innovation that promises to increase the learning of students or decrease the time it takes a student to learn deserves the attention of vocational educators. If learning can be held at a constant or increased, and at the same time the resources used in the teaching process can be lessened, we should do so from a cost efficiency perspective. Several ideas or practices come to mind:

1. decreasing the time length of multi-year or multi-semester programs;
2. using individualized instruction;
3. using the cooperative instructional process;
4. developing open entry and open exit programs;
5. employing para-professionals as teacher aids;
6. using computer assisted and computer managed instruction;
7. team teaching;
8. contracting with private schools or business and industry for instruction;
9. flexible scheduling;
10. recognize learning that has already occurred in other settings and credit such learning.

These and numerous other ideas hold promise for increasing the technological efficiency of vocational education. All entail a change over or retooling cost. Too often, little valid evidence exists regarding the positive or negative impact on learning of many of these proposed changes. In short, it is unfortunate that our educational engineers have only a crude set of tools with which to work in an environment that is filled with uncertainty.

However, when professional judgment, crude as it may be, tells us that instructional time can be lessened, or more students can be handled with some change or innovation, cost efficiency dictates that we listen and consider such change.

Increasing Cost Efficiency -- Problems and Concerns

The above scenario regarding vocational education outputs, inputs, and processors paints an obscure picture for increasing the cost efficiency

of vocational education. Let us try to remove some of the haze from the picture. From a conceptual and theoretical perspective, cost efficiency is a very clean and neat tool of economic analysis. It is well anchored in microeconomic theory and utilized in the private sector extensively.

However, numerous conceptual and measurement problems arise when we try to apply the concept to a public social intervention program such as vocational education. I would be shirking my role as an economist and vocational educator if I did not review and clarify for you some of these problems:

- First -- Prescriptive federal legislation and a long and illustrious history have not given vocational education clear and attainable goals. The goals of vocational education are not explicit. They are multi-dimensional and not even compatible. This makes it most difficult to establish a single functional relationship which encompasses all these goals. Without such a relationship, efficiency measures lose meaning.

- Second -- Numerous conceptual and practical problems exist in trying to quantify the costs of vocational education program inputs. The allocation of overhead costs to various programs, the establishment of amortization schedules for buildings and equipment, and the allocation of various support and ancillary services to programs, typify problems that can be managed, but are enormous. Unmanageable problems exist in trying to adjust the costs of investments made at different times to a common point in time. The common means, a discount rate, is difficult to employ. A final unmanageable problem which plagues the cost analyst is the awareness that market prices, as a true measure of real cost, are too often inadequate when they flow from other than competitive markets (Judy, 1969, pp. 21-27).

- Third -- In determining costs, we consider average unit costs instead of incremental costs. In doing so we ignore such factors as economies of scale and fixed facilities in the short run. Implicit in this is the faulty assumption that costs are a linear function of the number of students educated (Judy, 1969, pp. 21-27).

- Fourth -- We tend to ignore what economists call external costs. These are costs not borne by the agency responsible for the program. Costs associated with serving on a voca-

tional education advisory committee would be an example of an external cost.

- Fifth -- Inputs are not always used by the production unit that pays for them. For instance, a vocational teacher paid with vocational funds, who supervises study hall two hours per day, exemplifies the problem.

- Sixth -- We often do an inadequate job of examining the sensitivity of our cost and efficiency calculations. Such calculations are seldom precise, and we must be cognizant of their degree of variability (Judy, 1969, pp. 21-27).

- Seventh -- Cost efficiency analysis is much more useful for altering or otherwise improving the effectiveness of a program than for making comparisons between programs. The assumptions that underlie the technique are such that program outputs and inputs must be comparable in both their nature and means of measurement for the analysis to have meaning. It would be very difficult to meaningfully compare secondary and postsecondary vocational education programs using cost efficiency analysis.

- Eighth -- The most troublesome problem of all falls directly in our laps as educators. The specification and measurement of inputs into the process by which vocational capabilities are imparted to students suffer from the lack of a widely accepted theory of learning. If we do not know how the learning process really works, then specifying input variables becomes a guessing game (Stromsdorfer, 1972, p. 10).

Before we fall into the trap of believing that the "sky is falling" around the idea of using cost efficiency analysis with vocational education programs, let us redirect our focus. Decisions must be made regarding the allocation of resources among competing vocational education programs. Cost efficiency analysis, with all its shortcomings, forces the decision maker to concentrate on program costs, the efficiency of the instructional process, and the objectives of the program. As a way of thinking, the decision maker is forced to consider alternatives. More importantly, the decision maker is required to state explicitly and systematically the manner

in which decisions are arrived at. Cost efficiency analysis interjects a rational and systematic analysis into an area that for too long has been dominated by subjective and impressionistic analysis. As long as its limitations are noted and it is used only as an aid in decision making, it should be rigorously employed.

Climate of Beliefs for Utilizing Cost Efficiency Analysis

Cost efficiency analysis is an analytical tool that stands ready to assist the decision maker in improving the planning and evaluation of vocational education programs. It and other tools of analysis have met with resistance in the field. Serious questions have been raised about why vocational education planning and evaluation have not improved. Is there a lack of incentive or even a disincentive to improve planning and evaluation? Is the relationship between federal, state, and local vocational educators basically a nonintervention or "hands off" arrangement? Are vocational education administrators, planners, and evaluators inadequately prepared to handle their jobs (Atteberry, et al., 1977, pp. 150-161)?

Rather than debate the merit of or answer these questions at this time, I would rather list some attributes of a climate of beliefs I feel must exist before techniques such as cost efficiency analysis can flourish.

First, the vocational education community must come to realize that vocational education is a complex social phenomenon that is but one component of our society's system for developing human resources. It has social, economic, and educational components which must be integrated with social programs offered by a variety of private and governmental agencies. Vocational education is "big business", and we must begin to treat it as such.

Second, means must be self-imposed, if necessary, to make vocational education more accountable. What incentives are there for the public educator to keep costs down, to be more efficient, to see to it that objectives are being achieved? Excuses such as inadequate data, we are not factories, we have tenured teachers, and my professional judgment has always been good enough, must be seen for what they are -- merely excuses. With so much to be done and so little to do it with, we vocational educators must develop a genuine public zeal and attempt to give our students and our communities the "largest bang we can for each buck."

And third, we must lessen our reliance on our socio-political or "good old boys" skills. We must begin nurturing and refining our management skills. We must come to realize that the skills and experiences gained in teaching are not the skills or experiences necessary to administer vocational education programs. We must learn skills dealing with managing, planning, organizing, and controlling large and complex organizations. We must be trained in the use of the tools of the management scientists, the economist, the statistician, and the sociologist. Management teams consisting of individuals from diverse backgrounds must be formed. In short, we must rationalize our administrative behavior (Atteberry, et al., 1977, pp. 150-161).

I believe that efforts like the National Workshop on Improving the Cost-Effectiveness of Vocational Education Programs are important beginnings in creating the "climate of beliefs" that is necessary to improve the planning and evaluation of vocational education. We, as a vocational education community, have a long and laborious trip ahead of us. If, in meetings like this, we share our limited knowledge, continue to define and refine

our problems, and realize that we must learn to reason before we talk, we will succeed in our endeavors.

REFERENCES

Atteberry, J. W., Miller, W. R., & Pershing, J. A. *Improving vocational education planning: More myth than reality?* Columbia: University of Missouri, 1977.

Judy, R. W. Costs: Theoretical and methodological issues. In G. G. Somers & W. O. Wood (Eds.), *Cost-benefit analysis of manpower policies*. Canada: Hanson and Edgar, Ltd., 1969.

Lumsden, K., Attiyeh, R., & Bland, G. L. *Microeconomics*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1970.

Martin, R. S., & Miller, R. G. *Prologue to economic understanding*. Columbus, OH: Charles E. Merrill Books, Inc., 1961.

McConnell, C. R. *Economics: Principles, problems, and policies* (2nd ed.). New York: McGraw-Hill Book Company, Inc., 1963.

Stromsdorfer, E. W. *Review and synthesis of cost-effectiveness studies of vocational and technical education*. Columbus, OH: Center for Vocational and Technical Education, 1972.

Vocational Education Amendments. (Public Law 94-482) 20 U.S.C. 2301, Oct. 12, 1976.

CHAPTER IV

IMPROVING THE COST-EFFECTIVENESS OF VOCATIONAL EDUCATION PROGRAMS

George H. Copa*

Cost-effectiveness analysis as used in this paper is defined in its traditional sense as a ratio of process input measured in terms of monetary units (e.g., dollars) and process output measured in terms of physical or observable units (e.g., for an educational process, graduates, job entrants, those achieving mastery level of program content, decrease in crime rate). Cost-effectiveness analysis differs from cost-benefit analysis in that, with the latter, the process output is also measured in terms of monetary units -- a phenomenon that is difficult to do with the output of educational programs (Cohn, 1975; Warmbrod, 1968 & 1977; Stromsdorfer, 1972).

Cost-effectiveness analysis has its major use in decisions regarding the allocation of scarce resources to competing alternative processes. The alternatives may be different processes (e.g., different vocational education programs) or different levels of the same process. The analysis rests on the critical assumptions that: (1) resources are scarce, (2) total inputs to a process alternative can be identified and measured in monetary terms, (3) total outputs from the process can be identified and measured in observable terms, (4) output measures are valid given the purpose of the process,

---

*Dr. Copa is Professor and Associate Director of the Minnesota Research and Development Center for Vocational Education at the University of Minnesota, Minneapolis, Minnesota.

(5) process inputs can be related to process outputs, and (6) alternative processes or levels of process do exist. To the extent these assumptions are violated, and they often are in analysis of educational programs, the results of analysis are questionable for straightforward use in decision making. When threats to these assumptions are made explicit and their likely consequences described, cost-effectiveness analysis becomes much more useful for management purposes.

Major Management Decisions Affecting Vocational Education

Before focusing on a specific set of decisions, it may be useful to look more broadly at the management decisions affecting vocational education. This broader look is intended to provide a context within which to view different types of decisions and their relative dependence on one another. The decision classification scheme proposed is scale, product mix, production function, schedule, and location (Copa, 1977).

Scale

The decision about scale is one of deciding how much vocational education should be provided. Questions of scale relate specifically to the capacity of institutions providing vocational education services. Concern is with the substitutes for vocational education services such as on-the-job training, other educational programs, and self-instruction. Decisions about scale should be based on benefits vocational education can produce more efficiently than competitors providing the same kind of services and, in a much larger sense, education for work relative to the benefits of other services which could be provided with public funds (e.g., health, transportation, and housing). Viewed at the micro level, scale decisions

deal with the proper class size and institution size to maintain efficiency and quality service.

Product Mix

The proportion of vocational education programs offered in terms of content (e.g., agriculture, home economics, business), level (e.g., secondary, postsecondary, adult), and purpose (e.g., exploratory, specialization, continuing) is the focus of planning decisions concerning product mix for vocational education. Supposing that scale has been determined, product mix decisions concern the internal allocation of resources within vocational education itself. Here, the needs of individuals to be served and labor market demand must be specified to be useful. In addition, the information about alternative sources of supply for prepared workers must be considered in detail. Questions about the capacity, effectiveness, accessibility, and cost of alternatives to vocational education become relevant as decisions are made on a program-by-program basis. Discussions also center on specialization versus flexibility of preparation for individuals.

Production Function

"Production function" refers to how the product mix will be produced. What are the best formulas to prepare workers for various occupations? How long should the program be, and how much instruction should be in the classroom, laboratory, shop, or on-the-job? Should instruction be group-centered or individualized? What resources should be spent on guidance, instruction, administration, and evaluation? Decisions are made on how to allocate scarce resources to meet a particular program mix goal. Many factors come into play at this micro level of planning (e.g., facilities available, curriculum

materials, on-the-job training stations, and length of time the student can spend).

Schedule

Decisions about schedule concern the timing of vocational education services, ranging from whether to add and delete programs, to when a given program should be operated. Long-range versus short-range planning is at issue. Scheduling decisions are particularly important in avoiding surpluses and shortages since these conditions are often a function of time. For example, at the micro level, contrast the scheduling implications of constant-length programs with those allowing continuous entry and exit.

Location

Georgraphic location of programs requires decisions about numbers of institutions and their spatial distribution in a given geographic area. The issue of vocational programs in area centers versus home high schools is tied to the location question. Location of programs is highly correlated to accessibility and thereby the requirement of equal educational opportunity.

Summary

The first three types of decisions described (i.e., scale, product mix, and production function) deal with the process of vocational education from general to specific. With decisions of scale, the question is one of how many resources to vocational education as compared to its substitutes and competitors. In contrast, decisions about production function refer to the way specific inputs to vocational education are combined to make the process work. The decisions of schedule and location refer to the placement

in time and space of the process. All five of the decisions can be considered from a macro and micro perspective (e.g., at the national and at the local level).

The decisions used for illustration in this paper are those of product mix and production function. These were chosen because they are the most general, and usually made within vocational education, whereas decisions of scale are made outside of vocational education, usually only with information input from vocational education.

Alternative Concepts of the Purpose of Vocational Education

As another means of providing a context within which to view the usefulness of cost-effectiveness analysis, an attempt will be made to point out the existing lack of consensus on the purpose and, therefore, the measures of effectiveness for vocational education. The selected concepts are not exhaustive, but should serve to illustrate the divergence in defensible positions on this matter.

Serving Occupational Demand Concept

This concept of the purpose of vocational education focuses on meeting the needs of industry. The needs of industry are most simply defined as the number of job openings to be filled in various occupations. Industrial needs are taken to be a proxy measure for the needs of society in general, at least in an economic sense. The resource allocation consequences of using this concept are shown in Table IV-1 for a set of example vocational education programs.

In its simplist form the number of students served would be equal to the number of job openings if resources permitted. Since each job opening

is equal in importance and some are less expensive to prepare for (i.e., cost/student), an efficient manager would start by allocating resources to the least expensive program first (i.e., clerical) and proceed accordingly until all resources are expended.

TABLE IV-1

HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING OCCUPATIONAL DEMAND" CONCEPT OF VOCATIONAL EDUCATION

Example Program	Job Openings	Students Served	Cost/ Student	Resource Allocation
Accounting	18	18	$ 877	$ 15,786
Automotive Mechanics	25	25	1,671	41,775
Clerical	52	52	716	37,232
Commercial Cooking	30	30	1,718	51,540
Total	125	125		$146,333

Serving Student Need Concept

Here the concern is meeting the needs of the student. Although several definitions of "need" exist, the simplest is to provide the programs potential students indicate they will attend. The resource allocation consequences of implementing this concept are shown in Table IV-2.

Resources permitting, all student applicants would be served; if enough resources are not available, funding would start with the lowest cost program since all students and programs are considered of equal importance.

TABLE IV-2

HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING STUDENT NEED" CONCEPT OF VOCATIONAL EDUCATION

Example Program	Student Applicants	Students Served	Cost/ Student	Resource Allocation
Accounting	41	41	$ 877	$ 35,957
Automotive Mechanics	50	50	1,671	83,580
Clerical	40	40	716	28,640
Commercial Cooking	18	18	1,708	30,744
Total	149	149		$178,921

Serving Mutual Benefit Concept

This concept contains the notion of serving both society, in general, and students. Service is provided as long as both are benefiting. Resource allocation consequences are shown in Table IV-3. As is shown, the number served would be whichever is less, student applicants or job openings. Some students are turned away, and some job openings go unfilled.

TABLE IV-3

HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "SERVING MUTUAL BENEFIT" CONCEPT OF VOCATIONAL EDUCATION

Example Program	Student Applicants	Job Openings	Students Served	Cost/ Student	Resource Allocation
Accounting	41	18	18	$ 877	$ 15,786
Automotive Mechanics	50	25	25	1,671	41,775
Clerical	40	52	40	716	28,640
Commercial Cooking	18	30	30	1,718	51,540
Total	149	125	113		$137,741

Serving Market Success Concept

Another concept of vocational education holds that it should not try to "outguess" either its clients or industry. The focus here is on the success of clients in what they chose to do. A commonly used criteria of success is being able to get a job related to prior vocational education; however, success could be considered in a wide variety of ways. Using this concept, resource allocation might be conducted as shown in Table IV-4. As shown, the "success" criterion is related to placement. This criterion serves to assign programs' relative priority. In the example, students interested in the accounting program would be served first since that program is most successful in terms of related placement.

TABLE IV-4

HYPOTHETICAL EXAMPLE OF RESOURCE ALLOCATION WITH "MARKET SUCCESS" CONCEPT OF VOCATIONAL EDUCATION

Example Program	Student Applicants	Related Placement	Program Priority	Students Served	Cost/ Student	Resource Allocation
Accounting	41	80%	1	41	$ 877	$35,957
Automotive Mechanics	50	0	--		1,671	0
Clerical	40	30%	3	40	716	28,640
Commerical Cooking	18	60%	2	18	1,708	30,744
Total	149			99		$95,341

Summary

Explanation of the above illustrated alternative concepts of the purpose of vocational education has been very limited. It serves only to make the point that important differences exist which serve to limit the generalizability of cost-effectiveness analysis results even at the micro level of vocational education programs (e.g., within a single institution).

Even if there was consensus on one of the concepts illustrated, there are still a multitude of indicators which could be used to measure effectiveness within the concept. As was shown for the alternative concepts, so too for alternative measures within any of the concepts, the resource allocation consequences can differ widely. The implication is that use of cost-effective analysis with a naive understanding of the process to which it is being applied can be misleading and, at worst, disastrous. The next section of this paper will focus on improving cost-effectiveness of vocational education, assuming the reader has an understanding of vocational education and will act accordingly.

Using Economic Principles in Improving Cost-Effectiveness of Vocational Education

Rather than focus on a listing of specific activities which may relate to improving cost-effectiveness in vocational education but which may not be very generalizable to different situations, problems, locations and times, a set of economic principles will be advanced. Hopefully, the principles are much more generalizable than specific activities. Rather than viewing the principles as having to be applied according to the stringent rules of economic analysis, they should be thought of as a frame of reference -- a way to think about resource allocation problems.

Before going into a discussion of the principles, it may be well to distinguish between some important terms: input, output, process. Some example labels which fit each of these terms in vocational education are shown in Figure IV-1. In general, inputs are the items which are used in the process to produce the output. Inputs can be further subdivided into fixed and variable; renewable and nonrenewable; land, labor, capitol, and management; individual and societal. Process refers to the technology or means for combining inputs with a particular purpose in mind. In vocational education, a common type of technology consists of schools with programs conducted in classrooms and shops. Output refers to the result of the process component. It can be measured in terms of direct and indirect effects and at various points in time relative to the process (e.g., during, at the end, or some time after the process). In vocational education, primary focus is on the students as outputs and how they have been changed during the process of vocational education.

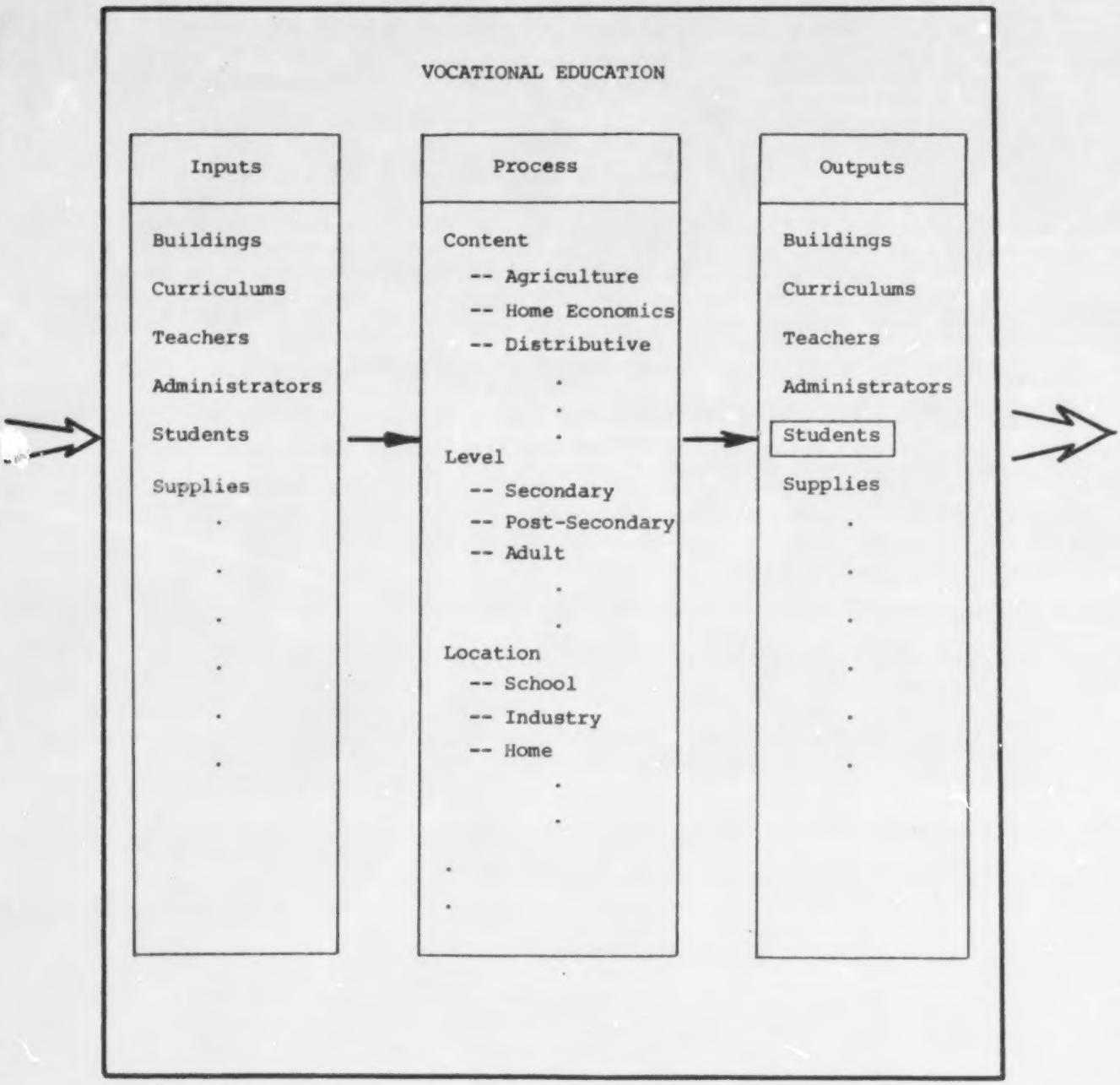
The economic principles which follow concern the analysis of the relationship of inputs to each other and to outputs, thereby characterizing the process under study (in this case, vocational education). The economic principles described are diminishing returns, equal-marginal returns, opportunity costs, resource substitution, and product substitution. The concepts of fixed and variable costs are also described.

Diminishing Returns

This principle concerns the relationship of a single input to a single output, given that all other inputs are held constant. The principle states that as the variable input is added, the marginal output declines after an initial stage of increasing marginal output. Marginal

FIGURE IV-1

INPUTS, PROCESS AND OUTPUTS OF VOCATIONAL EDUCATION



output refers to the output added after the addition of the last unit of input. As an example, consider the relationship between hours of classroom instruction and job-related placement of graduates. To make this a cost-effectiveness problem, a price can be placed on hours of classroom instruction; let's assume it is $100 per hour. The data might look as in Table IV-5. From viewing Table IV-5, it is apparent that diminishing returns start to set in somewhere between 360 and 450 hours of classroom instruction. This relationship is more apparent in Figure IV-2, which shows a graph of the data in Table IV-5. Note in Figure IV-2 that although decreasing marginal output starts in after $36,000 worth of instructional time, output (job-related placement) is still increasing, but not as fast as previously. Total output does not decrease until after $72,000 worth of instruction, at which point marginal output turns negative.

Since it is difficult to put a monetary value on the output in Figure IV-2, what can be gleaned from using the principle of diminishing returns is to identify where one is in terms of the productivity of an input. Is the input being used at a point of increasing or decreasing returns? In most cases it would not be prudent to use the input beyond the point where marginal output becomes zero (i.e., in this example, somewhere between 630 and 720 hours of instruction).

Figure IV-2 illustrated the use of the principle of diminishing returns with only one input and output of vocational education (i.e., hours of classroom instruction and job-related placement, respectively). Since this is being done in the context of cost-effectiveness analysis, the input has been converted to monetary terms. If this conversion was also possible for output, additional analysis for improved management could be

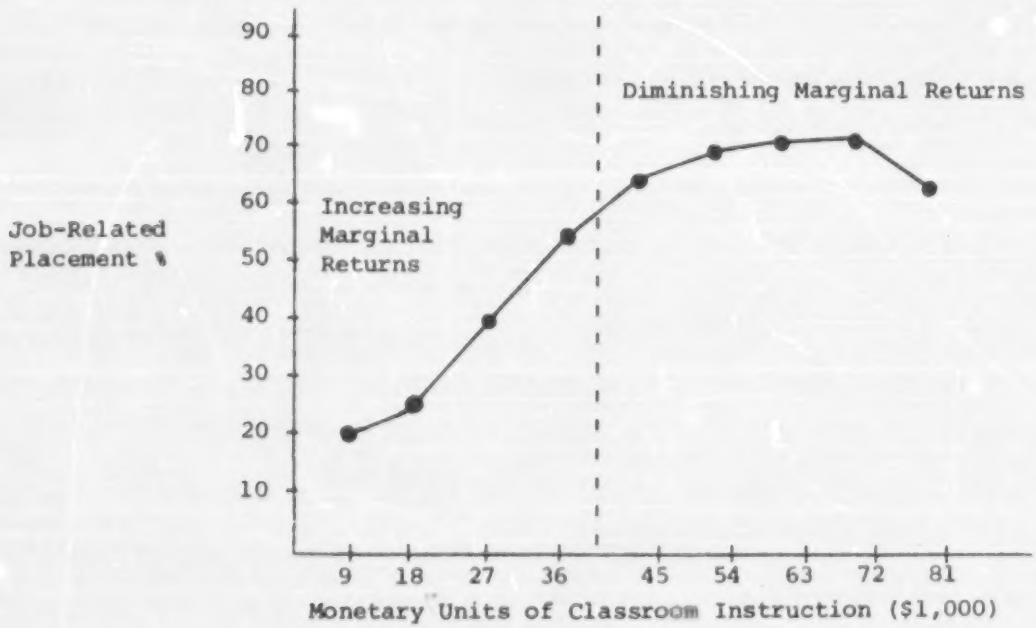
TABLE IV-5

HYPOTHETICAL EXAMPLE OF COST OF CLASSROOM INSTRUCTION IN RELATION TO JOB-RELATED PLACEMENT OF GRADUATES (AN ILLUSTRATION OF DIMINISHING RETURNS)

Hours of Classroom Instruction	Cost/ Hour	Cost of Instruction	Job-Related Placement (%)	Marginal Increase in Job-Related Placement (%)
90	$100	9,000	20%	--
180	100	18,000	25	+ 5%
270	100	27,000	40	+15
360	100	36,000	55	+15
450	100	45,000	65	+10
540	100	54,000	70	+ 5
630	100	63,000	72	+ 2
720	100	72,000	72	0
810	100	81,000	65	- 7

FIGURE IV-2

HYPOTHETICAL EXAMPLE OF RELATIONSHIP OF COST OF CLASSROOM INSTRUCTION TO JOB-RELATED PLACEMENT OF GRADUATES (AN ILLUSTRATION OF DIMINISHING RETURNS)



described. Diminishing returns analysis can be applied for all of vocational education's inputs (e.g., hours of management, amount of supplies, amount of curriculum support materials, hours of cooperative work experience, availability of job-placement service). Remember, the relationship for a single input to output may be very different for different indicators of output (effectiveness).

Opportunity Costs

Opportunity cost describes the cost of using an input one way relative to the output that would be obtained from using it in the next best way. If a teacher's time is used to teach in the classroom, it can't be used in the shop; if money is used to buy new welders for the welding program, it can't be used to buy typewriters for the secretarial program; if money is used to renovate the commercial cooking facilities, the same resources can't be used to pave the parking lot; if a student takes fashion merchandising, the student cannot take nursing at the same time. Assuming the alternative listed above is the next best, in each instance, the opportunity costs are teaching in shop, typewriters for secretarial program, paving parking lot, and nursing, respectively.

An example illustrating the use of the principle of opportunity costs is shown in Table IV-6. The example shows the opportunity costs of using units of $10,000 worth of classroom instructional time in three different vocational education programs in terms of job-related placement. In other words, opportunity cost of the use of $10,000 of instructional time in one program is the increase in job-related placement which could have been obtained by investing the $10,000 the next best way.

TABLE IV-6

HYPOTHETICAL EXAMPLE OF OPPORTUNITY COSTS OF $10,000 UNITS OF CLASSROOM INSTRUCTIONAL TIME INVESTED IN THREE VOCATIONAL EDUCATION PROGRAMS (AN ILLUSTRATION OF OPPORTUNITY COSTS)

	Amount of Investment	Marginal Change in Job-Related Placement (%)		
		Welding	Secretarial	Agri-Business
First	$10,000	+20^{3}	+30^{2}	+45^{1}
Second	$10,000	+18^{4}	+11^{8}	+17^{5}
Third	$10,000	+15^{6}	+ 9	+ 8
Fourth	$10,000	+12^{7}	+ 5	+ 2
Fifth	$10,000	+ 5	+ 5	0
Sixth	$10,000	+ 5	0	0
Seventh	$10,000	+ 2	- 5	0
Eighth	$10,000	0	-10	- 2
Return from Investing Entire $80,000 in One Program		+77	+45	+70

For example, in Table IV-6 the best use of the first $10,000 is with the agri-business program; it generated an increase in output of +45 percent. The next best use of the first $10,000 is the secretarial program which generated +30 percent increase in output. The numbers underlined along the percentages in Table IV-6 show the order of investing $10,000 units of classroom instructional time among the programs using the principle of opportunity costs. The amount of resources allocated to each program would be welding ($40,000), secretarial ($20,000), and agri-business ($20,000). With this allocation strategy, the total increase in job-related placement is 168 percent (i.e., 45 + 30 + 20 + 18 + 17 + 15 + 12 + 11). This increase can

be contrasted with the result of investing the full $80,000 in any one of the programs as shown in the last row of Table IV-6.

The principle of opportunity costs is especially useful in making resource allocations among alternatives, whereas for the principle of diminishing returns, the focus was on resource allocation within an alternative. Using this principle, resources are allocated among alternative uses in order of highest to lowest marginal increase in output of the resources (i.e., in order of decreasing opportunity costs). Allocating resources in this way represents application of the principle of equal-marginal returns.

In order to make the comparisons among alternatives, it is necessary that their output be measured in the same units; and more important, that the output measure be equally valid given the purpose of the alternative processes. Although a natural set of alternatives for comparison in the context of vocational education is programs (e.g., welding, secretarial), other sets could be levels (e.g., secondary, postsecondary, adult), institutions (e.g., high schools, vocational centers, community colleges), and so forth. Again as a point of emphasis, care must be taken so as to insure that alternatives being compared have the same purpose (e.g., agriculture programs may have a vastly different purpose than home economics programs).

Fixed and Variable Costs

The ability to distinguish between the fixed and variable costs of producing an output is important when estimating the costs of making changes in the production process, and in considerations of the short versus long run. Fixed costs, sometimes call overhead costs, are those costs which do

not change with changes in output. They go on whether anything is produced or not. Some typical examples are interest and depreciation. In the short run in vocational education, after staff contracts are signed, fixed costs might include teacher and administrator salaries. Since fixed costs do not vary, the fixed cost per unit of output declines as more units are produced. These two relationships are shown in Figures IV-3 and IV-4 for the output of graduates of vocational education.

FIGURE IV-3

HYPOTHETICAL EXAMPLE OF RELATIONSHIP OF TOTAL ANNUAL FIXED COSTS TO NUMBER OF GRADUATES PRODUCED

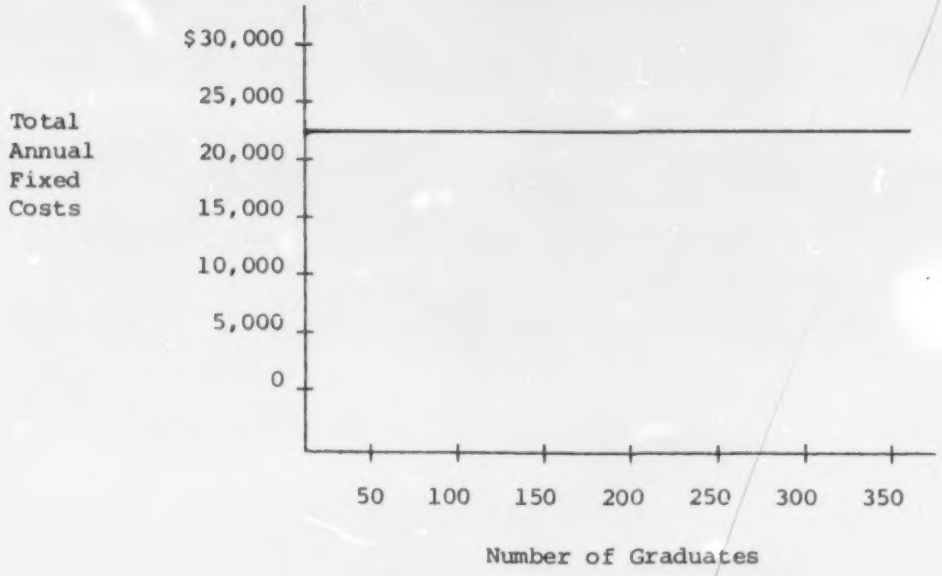
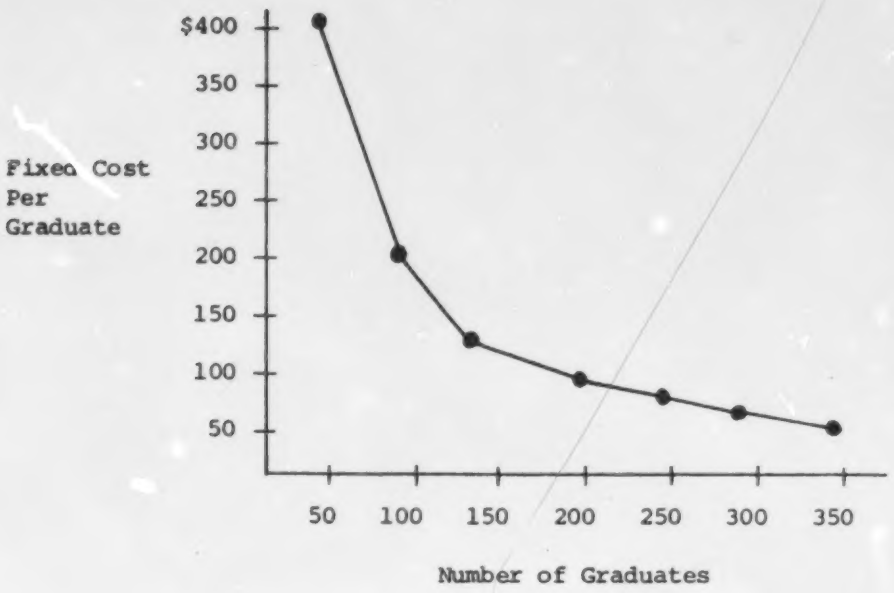


FIGURE IV-4

HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF ANNUAL FIXED COSTS PER GRADUATE TO TOTAL NUMBER OF GRADUATES PRODUCED



Variable costs, sometimes called operating costs, are those which change with the amount of output produced. Variable costs in vocational education are best illustrated by those which vary with the number of sutdents served (e.g., supplies, desks, individualized instructional time, curriculum materials). Figure IV-5 shows a typical relationship of variable cost per unit of output. Total variable costs increase with increased output as shown in Figure IV-6.

FIGURE IV-5

HYPOTHETICAL EXAMPLE SHOWING POSSIBLE RELATIONSHIPS OF VARIABLE COSTS PER GRADUATE PRODUCED

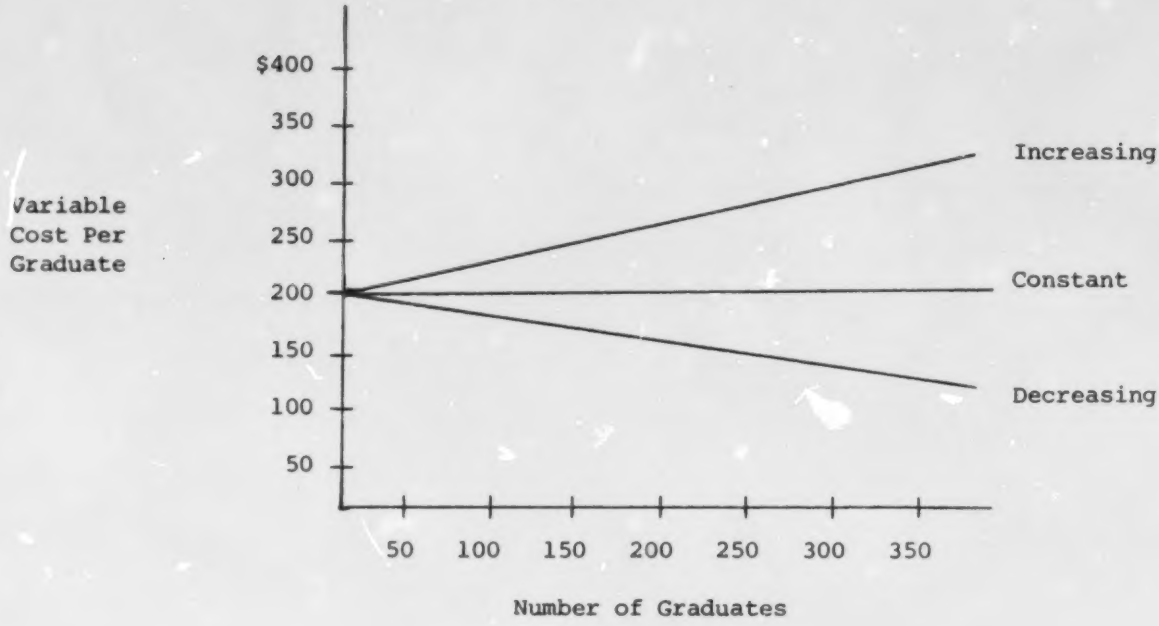
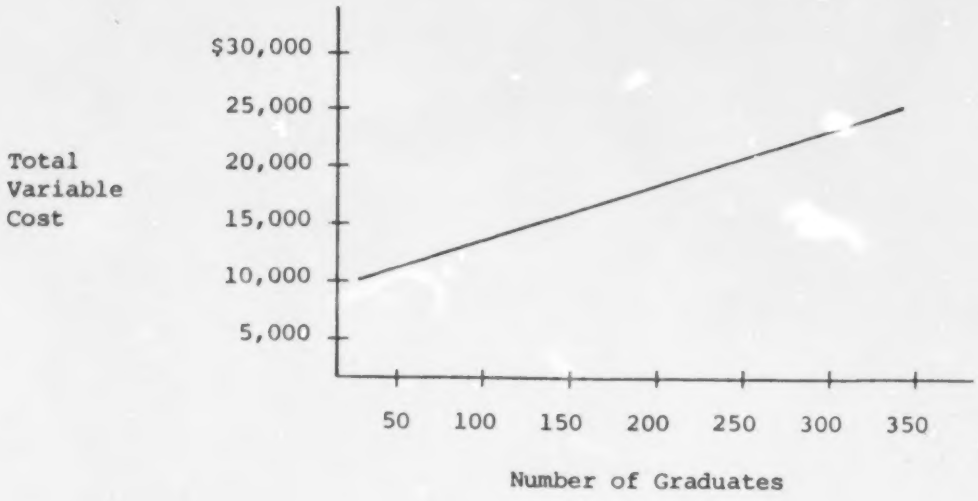


FIGURE IV-6

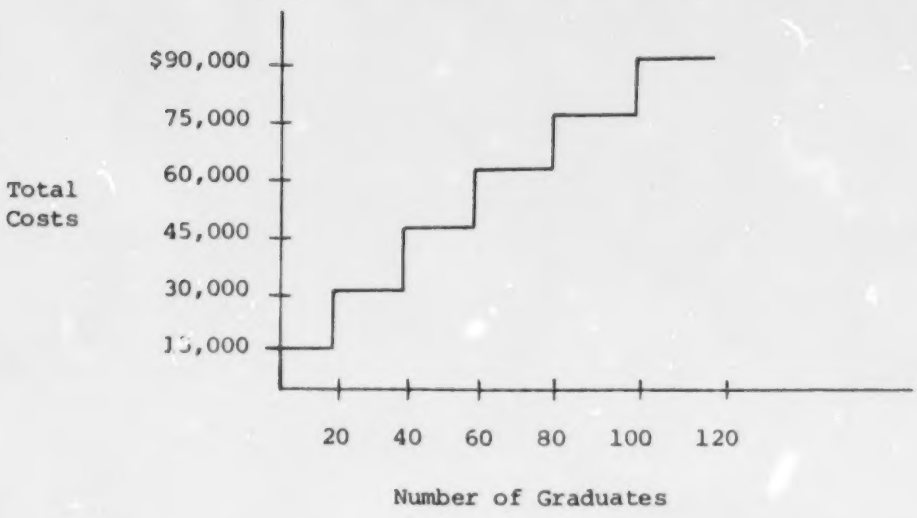
HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF TOTAL VARIABLE COSTS TO NUMBER OF GRADUATES PRODUCED



Certain inputs to the production process may have both a fixed and variable cost component. For example, in vocational education, typically, the amount of teacher's time needed to teach a classroom of students is relatively fixed regardless of the number of students in the class; however, the amount of time needed for the same class for individualized instruction and grading is likely to be variable and very dependent on the number of students in the class. In this case, total costs jump up every time the number of students increases beyond some pre-defined student/teacher ratio. Several of the inputs used in vocational education are not very divisible, and therefore cannot be added in small units (e.g., teachers, classrooms, shops). Given this situation, the cost relationship to number of graduates of a particular vocational education program is likely to be "stepped" as shown in Figure IV-7 (Zymelman, 1973).

FIGURE IV-7

HYPOTHETICAL EXAMPLE SHOWING STEPPED RELATIONSHIP OF TOTAL COSTS TO NUMBER OF GRADUATES PRODUCED



The unit of time over which costs are being calculated is important in determining which costs are fixed and variable. One definition of the long run is that time which is long enough so that all costs are variable. Long enough, for example, for new buildings to be built or current ones remodeled, or for new programs to be added or old ones deleted. As the unit of time is shortened, more of the costs become fixed. For example, as already noted, once teachers' contracts are signed, that cost becomes fixed for the year no matter how their time is used.

Several types of costs have now been described: fixed costs, variable costs, marginal costs, and total costs. Another type of cost is average cost, which is simply the total cost divided by the number of units of output. Each of these cost figures has a different meaning and specific use. Care must be taken so that they are not misused. For example, average cost is often used in cost-effectiveness ratios when it is the marginal cost that is relevant to the decision being made. Average cost is most useful when considering long run operation of alternative vocational education processes while marginal cost is useful in the short run, particularly when deciding the appropriate level for a selected process. A related point is that effectiveness can be measured in both marginal and average terms. When marginal costs are used, effectiveness should be presented marginally, and likewise when using averages (Levin, 1975). The differences between various types of costs may be better understood by examining Figure IV-8.

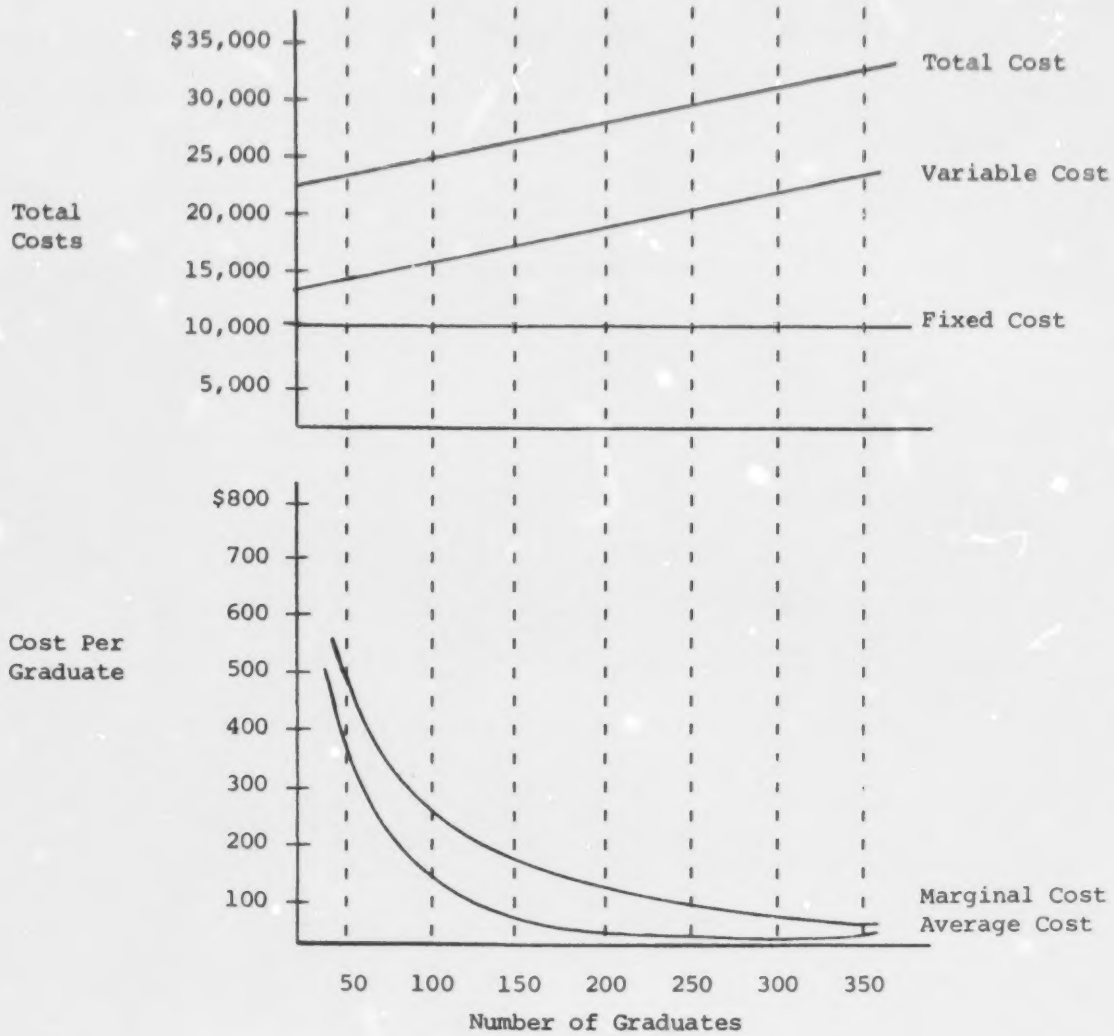
Resource Substitution

So far, the focus has been on the relationship of one input to output (i.e., diminishing returns, opportunity costs, and equal-margined returns), or groups of inputs and outputs (i.e., fixed and variable costs). The

principle of resource substitution assists in decisions where two different inputs can be used in varying amounts to produce a fixed amount of output and where the inputs can be substitutes for each other. Examples are hours of classroom time and hours of cooperative work experience time used to produce graduates with high job-related placement. A typical relationship which develops between two substitutable inputs is shown in Figure IV-9.

FIGURE IV-8

HYPOTHETICAL EXAMPLE SHOWING SEVERAL TYPES OF COSTS

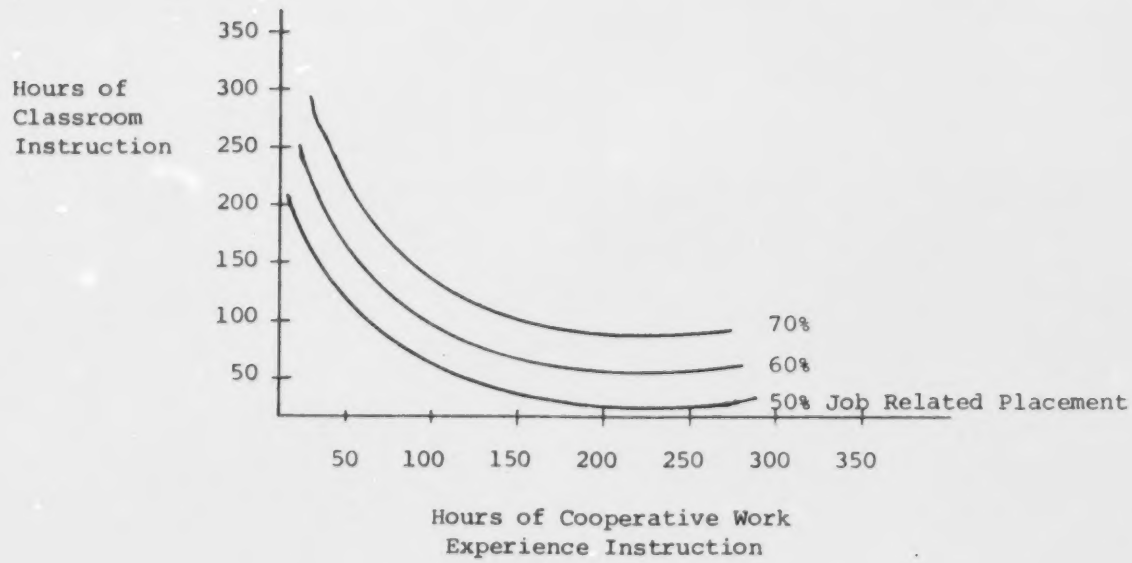


In this case, the ratio of change in replaced resource (i.e., classroom time) to the change in added resource (i.e., work-experience time) is decreasing; that is, it takes more work experience time to replace an hour of classroom time as more work-experience time is added to produce the same output. The curved lines shown in Figure IV-9 represent all possible combinations of the two inputs to produce selected amounts of output (i.e., job-related placement).

Using the relationship shown in Figure IV-9, the amount of resources which should be spent on each input can be determined, given that the price of each input is known.

FIGURE IV-9

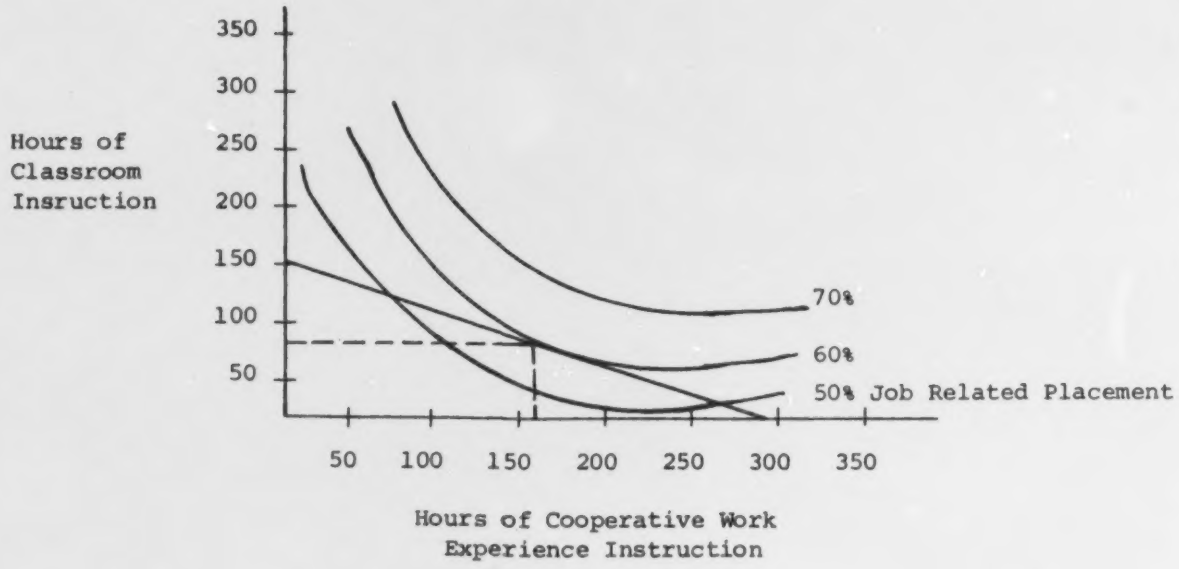
HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF CLASSROOM INSTRUCTION TO WORK EXPERIENCE INSTRUCTION IN PRODUCING GRADUATES WITH JOB-RELATED PLACEMENT (AN ILLUSTRATION OF RESOURCE SUBSTITUTION)



In the example, if the cost of classroom instruction is $100 per hour and the cost of work experience time is $50 per hour, and given a budget of $15,000, if all resources were spent on classroom time, 150 hours could be purchased. If all resources were spent on work-experience time, 300 hours could be purchased. Plotting these points and drawing a straight line between them (representing all possible combinations of the two inputs which could be purchased with the $15,000) gives the diagram shown in Figure IV-10. As should be evident, the highest amount of output (i.e., job-related placement), staying within the budget of $15,000, could be obtained by using about 100 hours of classroom time and 150 hours of work experience time. With this combination of inputs, job-related placement would be at 60 percent.

FIGURE IV-10

HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF CLASSROOM INSTRUCTION TO WORK-EXPERIENCE INSTRUCTION IN PRODUCING GRADUATES WITH JOB-RELATED PLACEMENT AND RESOURCE ALLOCATION (AN ILLUSTRATION OF RESOURCE SUBSTITUTION)



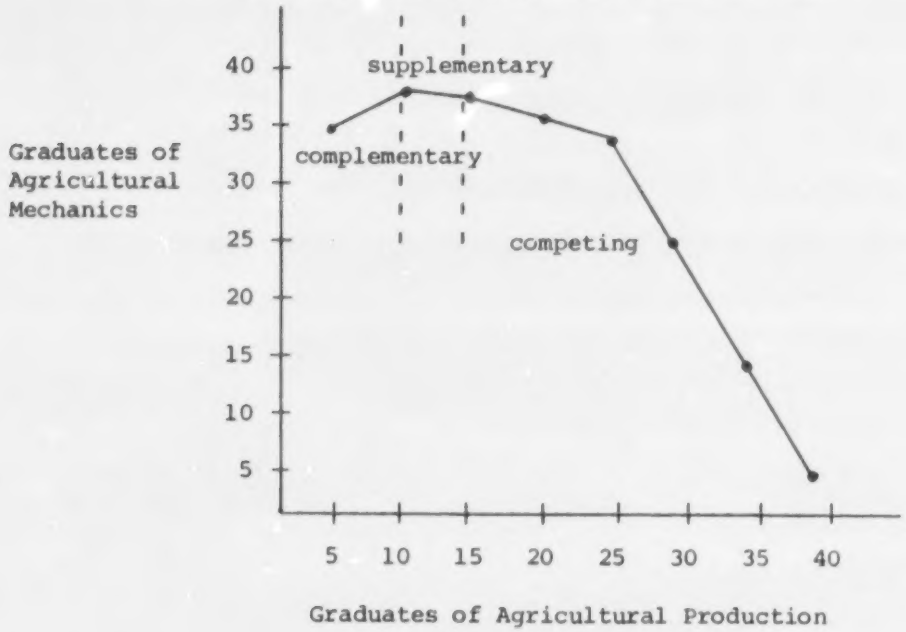
The principle of resource substitution is useful in management decisions concerning resource allocation to inputs which are substitutes for one another. It is an analytical way of thinking about this problem. Examples of substitutable inputs in vocational education are group instruction and individualized instruction, textbooks and single concept materials, classroom instruction and field trips or shop or laboratory instruction, teacher with work experience and teacher without, teacher with degrees and teacher without, teacher as counselor and separate counseling staff.

Product Substitution

As the principle of resource substitution concerned two inputs, the principle of product substitution refers to the relationship between two outputs. For illustration, let's assume the two outcomes are graduates with training in agricultural mechanics and graduates with training in agricultural production. Let's further assume that an agricultural production program is now being operated and observe what might happen as an agricultural mechanics program is initiated and expanded. At first, the existance of an agricultural mechanics program might increase the number of agriculture production graduates. One reason might be that some of the students who would not have enrolled before but came because of the agriculture mechanics program decide after getting there to change their enrollment to agricultural production. Next, as the agricultural mechanics program expands, it might no longer increase the agricultural production enrollment. With still more expansion of agricultural mechanics, the two programs might start competing for students and an increase in one means a decrease in the other. These three relationships are shown in Figure IV-11 -- first, complementary; then, supplementary; and last, competitive.

FIGURE IV-11

HYPOTHETICAL EXAMPLE SHOWING RELATIONSHIP OF PRODUCING GRADUATES OF AGRICULTURAL MECHANICS TO GRADUATES OF AGRICULTURAL PRODUCTION (AN ILLUSTRATION OF PRODUCT SUBSTITUTION)



Using the principle of product substitution, the wise manager would operate at least at the right-hand edge of the supplementary stage of substitution, if there is demand for both outputs. To the extent one output is valued over another, the manager would move into the competitive stage. Vocational education has many substitutable outputs (e.g., one program's graduates versus another, postsecondary programs versus adult programs) and output indicators (e.g., high placement versus serving special needs groups, generalizable skills versus specialized skills, occupational demand versus student interest).

Summary

The first section of this paper dealt with a classification system of the types of management decisions made in vocational education. These decisions involve the relationship between inputs and between inputs and outputs in vocational education. Implications of different concepts of the purpose of vocational education were illustrated. The presentation was intended to provide a context for assessing the use and limitations of cost-effectiveness analysis in vocational education. Limitation centers on the lack of agreement about inputs and outputs and their appropriate measurement. Those limitations, and the important methodological problems in past cost-effectiveness studies in vocational education (e.g., lack of adequate control group, lack of marginal cost and effectiveness data, lack of consideration of the effects of other variables) (Stromsdorfer, 1972), indicate that much work remains to be done if cost-effectiveness analysis is to achieve a valid impact on changes made in vocational education.

In the last section of the paper, a series of economic principles were described to help managers improve the cost-effectiveness of vocational education by sorting and organizing relevant information.

REFERENCES

Bilas, R. A. *Micro-economic theory: A graphic analysis*. St. Louis: McGraw-Hill Book Company, 1967.

Cohn, E. *The economics of education*. Cambridge, MA: Mallinger Publishing Co., 1975.

Copa, G. H. The economics of planning vocational education. In W. Meyer (Ed.), *Vocational education and the nation's economy*. Washington, DC: American Vocational Association, 1977.

Herbst, J. H. *Farm management principles, budgets, plans*. Champaign, IL: Stipes Publishing Company, 1976.

Levin, H. M. Cost-effectiveness analysis in evaluation research. In M. Guttentag & E. L. Struening (Eds.), *Handbook of evaluation research* (Vol. 2). Beverly Hills, CA: SAGE Publications, Inc., 1975.

Stromsdorfer, E. W. *Review and synthesis of cost-effectiveness studies of vocational and technical education*. Columbus, OH: The Center for Vocational Education, 1972.

Vickrey, W. S. *Microstatics*. Chicago, IL: Harcourt, Brace & World, Inc., 1964.

Warmbrod, J. R. *Review and synthesis on the economics of vocational-technical education*. Columbus, OH: The Center for Vocational Education, 1968.

Warmbrod, J. R. Cost-benefit analysis and cost-effectiveness analysis in education and vocational education. In W. Meyer (Ed.), *Vocational education and the nation's economy*. Washington, DC: American Vocational Association, 1977.

Zymelman, M. *Cost-effectiveness of alternative learning technologies in industrial training -- a study of in-plant training and vocational schools* (Bank Staff Working Paper No. 169). Washington, DC: International Development Associates, International Bank for Reconstruction and Development, December 1973.

CHAPTER V

NOMINAL GROUP MEETING FOR PROBLEM EXPLORATION

This chapter describes the nature and process of the nominal group meeting and discusses its application in identifying priority problems in developmental strategies.

The Nature and Process of Nominal Group Meeting

The nominal group meeting is a structured group meeting which brings individuals together to generate, discuss and vote on priority problems. The nature of the nominal group technique and the process of nominal group meetings are summarized below.

The Nature of the Nominal Group Technique

The nominal group technique was developed as a deliberate, structured process for problem exploration. It attempts to: (1) facilitate problem definition, (2) focus attention on those items with the biggest priority, (3) avoid reaching toward a few leaders, (4) create sufficient tension to provoke responsiveness, (5) provide a mechanism for interfacing of groups, and (6) increase the legitimization of program proposals (Delbecq & Van de Ven, 1971, p. 478). As a group process in program planning, the nominal group technique has been widely applied in defining problems, aggregating group judgments, determining priorities, and involving citizens in the decision-making process.

In their book, Delbecq, Van de Ven, and Gustafson (1975) summarize the procedure of the nominal group technique (NGT) as follows:

1. Silent generation of ideas in writing.
2. Round robin feedback from group members and the recording of each idea in a terse phrase on a flip chart.
3. Discussion of each recorded idea for clarification and evaluation.
4. Individual voting on priority ideas with the group decision being mathematically derived through rank-ordering or rating (p. 8).

The authors also have developed guidelines for conducting NGT meetings which include preparatory tasks and specified activities for the NGT process (pp. 40-82).

The Process of the Nominal Group Meeting

Referring to the guidelines as developed by Delbecq and others, the project staff developed a step-by-step procedure for training purposes. For the meeting, small group space should be prepared along with a table and chairs for group members. A large flip chart or small blackboard should be placed at the head of each table for the recording of group responses. The following supplies should be provided: (1) three black and red felt markers, (2) masking tape, (3) nominal group format, (4) small (3" x 5") cards, and (5) pencils.

The whole group should be divided into small groups (six to nine people) randomly or nominally, and group leaders who have been trained or who are experienced in the nominal group meeting technique should be available.

At the beginning of the meeting, group leaders should offer a cordial welcome to group members and explain the nature and importance of task accomplishment, the importance of participation by all members of the group, the theme of the meeting, and the specific steps with a time allocation as follows:

Step 1: Silent generation of ideas in writing stimulated by a question -- (15 minutes)

Step 2: Round robin listing of ideas generated from each member on a flip chart -- (30 minutes)

Step 3: Serial discussion of each idea -- (15 minutes)

Step 4: Silent listing and ranking of priorities on 3" x 5" cards -- (15 minutes)

Step 5: Voting on priorities of ideas -- (5 minutes)

Step 1: Silent generation of ideas in writing stimulated by a question -- (15 minutes)

The first step in the nominal group meeting is to have the group members write key ideas silently and independently. Participants should be expected to focus their attention on the question which is found in the nominal group form.

Procedures for Step 1:

a. Distribute the nominal group form describing the discussion topic to the group members.
b. Read the question aloud.
c. Explain that specific critical incidents or problems are desired as responses.
d. Direct the group to write in brief phrases or statements.
e. Ask the group to work silently and independently.
f. Ask participants to begin writing.
g. Model good group behavior.

Step 2: Round robin recording of ideas -- (30 minutes)

The second step is to record the ideas of group members on a flip chart visible to the entire group. Round robin recording means going around the table and asking for one idea from one member at a time.

Procedures for Step 2:

a. Ask a group member for the first item in his listing of problems.
b. Continue to request participants in the group to present the items that they have listed one at a time in turn around the group.
c. As participants to alternate columns in listing the items.
d. Record responses on the flip chart so that the items are visible to the group members.
e. Request that duplicate items to the responses already recorded on the flip chart not be restated.
f. Explain to participants that if new ideas are generated by the procedure, these can be added to their own list and to the group list in turn.

Step 3: Serial discussion for clarification of each item -- (15 minutes)

The third step is to discuss each idea in turn. The purpose of this step is clarification of meaning of the items.

Procedures for Step 3:

a. Point to the first item and read it aloud.
b. Ask if there are any questions, statements of clarification, or statements of agreement or disagreement any members might have about the item.
c. Follow procedures (a) and (b) for the remaining items.

Step 4: Silent listing and ranking of priorities on 3" x 5" cards -- (15 minutes)

By having group members independently assess the priority of the items, judgmental accuracy is increased. This procedure avoids the influence of prestigious or vocal members on the group's decision-making process.

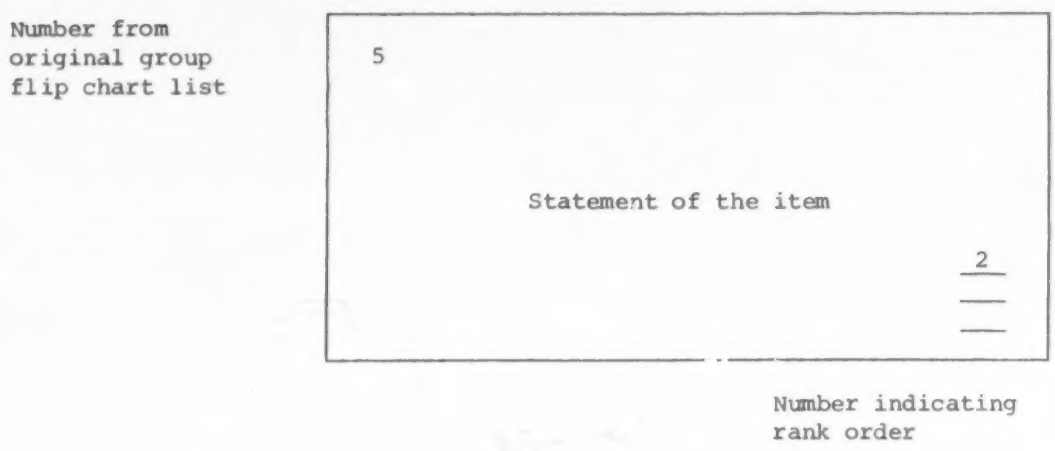
Procedures for Step 4:

a. Request each participant to list nominally on 3" x 5" cards (by name and number) those five items he considers most important. One 3" x 5" card is used for each item of importance.
b. Ask group members to choose the most important of the five items which they have recorded on the cards. Tell group members to place the numeral five (5) in the bottom right-hand corner of the card and underline the numeral three (3) times. Request that the card be put aside.

c. When the completed card is put aside, ask group members to focus their attention on the remaining four cards. Of these cards, ask that participants choose the least important item. On this card the numeral one (1) should be recorded in the same manner as the numeral was recorded on the previous card. This card should then be removed from consideration.

d. Continue the procedure with the most important of the three remaining and the recording of the numeral four (4) on this card, and subsequent removal of this card. Then, the least important of two remaining, the recording of numeral two (2), and removal. The final remaining card will become the middle card and will contain the numeral three (3) in the bottom right-hand position.

The following figure illustrates the index card with rank-order made by each member.



Step 5: Voting on priorities of items -- (5 minutes)

The fifth step is to record the individual voting on priorities on the flip chart so that the results are visible to all group members. The average vote is taken for each item, and the five priority items will be reported at the whole group session.

Procedures for Step 5:

a. Ask participants to read to the recorder or group leader the numbers and rankings of priority items.

b. Record the votes on a flip chart sheet and tally the votes given to the items. Take the average for each item. Share the results with group members.

The following figure illustrates a voting tally sheet on a flip chart with recorded votes:

Numbers of Items	Rank-Order Scores	Total
1	3 - 2 - 2	(7)
2	2 - 4 - 1 - 2	(9)
3	2	(2)
4	5 - 4 - 5 - 5	(19)
5		(0)
6	1 - 2	(3)
.		
.		
.		

c. From the average for each item, calculate the group's choice for the five priority items. Share these results with the group and inform the group members that these items will be considered the group's choice for the five priority items.
d. Record the group's decision on 3" x 5" cards in the format utilized in Step 4 to be reported at the whole group session.

After the nominal group meeting, the ideas with priorities determined by the group are presented to the entire group of participants and discussed among the groups. Then the final results are summarized.

Problems in Developmental Strategies

Following the procedures for the nominal group meeting mentioned above, five nominal group members identified five top priority problems in developmental strategies and presented them at the whole group session. The results fr . the three separate meetings for three strategy topics are described below.

Problems in Improving Program Effectiveness

Five top priority problems in improving program effectiveness which were determined by each group were presented at the general session. Those

problems are listed in order.

Group one presented the following problem items:

1. Lack of consensus on goals and objectives of vocational education
2. Governmental regulations
3. Rejection of the idea of improving the effectiveness of vocational education
4. Resistance to change
5. Lack of proper facilities

Group two presented the following problem items:

1. Lack of consistent definitions
2. Turfmanship (boundary lines)
3. Inadequate personnel training
4. Resistance to change
5. Institutional stress and staff demoralization

Group three presented the following program items:

1. Historical practice -- inadequate information
2. Lack of personnel policies/coordination with other systems
3. Lack of consistent definitions
4. Fear of consequences
5. Communication/interpretation

Group four presented the following problem items:

1. Limited resources (financial, human, equipmental, etc.)
2. Lack of reliable data
3. Fear of consequences
4. Lack of planning
5. Philosophical differences between educators and the public toward vocational education

Group five presented the following problem items:

1. Lack of dedicated resources
2. Perceptions and attitudes toward vocational education
3. Commitment to change by policy makers
4. Turfmanship (boundary lines)
5. Definition of criteria

After whole group discussions, the priority order for problems was converted into weighting points (five through one). For example, the first priority problem was weighted by five points and the fifth priority problem

was given one point. All the priority problems in improving program effectiveness which were presented by the groups were combined in Table V-1.

Based on the weighting points, five top priority problems identified by the entire group were: (1) lack of consensus on goals/definitions/criteria, (2) limited resources, (3) lack of adequate information, (4) resistance to change, and (5) turfmanship (see Table V-1).

TABLE V-1

PRIORITY PROBLEMS IN IMPROVING PROGRAM EFFECTIVENESS

	Problem Item	Weighting Points	Total
1.	Lack of consensus on goals/definitions/criteria	(5) (5) (3) (1)	14
2.	Limited resources	(5) (5) (1)	11
3.	Lack of adequate information	(5) (4)	9
4.	Resistance to change	(2) (2) (3)	7
5.	Turfmanship (boundary lines)	(4) (2)	6
6.	Fear of consequences	(2) (3)	5
7.	Philosophical differences/attitudes	(1) (4)	5
8.	Governmental regulations	(4)	4
9.	Lack of personnel coordination	(4)	4
10.	Rejection of the idea	(3)	3
11.	Inadequate personnel training	(3)	3
12.	Lack of planning	(2)	2
13.	Communication/interpretation	(1)	1
14.	Staff demoralization	(1)	1

Problems in Increasing Cost Efficiency

At a general session, each group presented five top priority problems which they may face in increasing cost efficiency of vocational programs.

The problems are listed in priority order.

Group one:

1. Political influences
2. Difficulty in identification of costs
3. Student recruitment and selection procedures
4. Ignorance of cost efficiency techniques
5. Class size

Group two:

1. Lack of adequate cost efficiency techniques
2. Rigid fiscal procedures
3. Fear of allocations being cut
4. Fear of manipulation or misinterpretation
5. Increased percentage of allocations for staff

Group three:

1. Lack of understanding of optimal trade-off concepts
2. Inability to obtain realistic cost efficiency
3. Ignorance of cost efficiency techniques
4. Rigid fiscal procedures
5. Inappropriate methods for allocating funds

Group four:

1. Lack of adequate budgeting and accounting systems
2. Cost of data collection and reporting
3. Inaccurate reporting of cost data
4. Budgeting not based on program objectives
5. Difficulty in identification of costs

Group five:

1. Government regulations
2. Fluctuation in student enrollments
3. Inflation
4. Resistance to change
5. Politically based decisions

After whole group discussions, the priority problems were weighted by five through one points as summarized in Table V-2. Thirteen problem items were identified. The top five priority problems were found to be: (1) ignorance of cost efficiency techniques, (2) class size/enrollment/student recruitment, (3) lack of adequate budgeting and accounting systems, (4) cost of

data collection/inaccurate data, (5) political influence linked to rigid fiscal procedures.

Problems in Improving Cost-Effectiveness of Vocational Programs

The top priority problems identified by each group were presented at a general session and discussed among the groups. The problem items are listed in order by group.

Group one:

1. Inaccuracies in predicting job opportunities
2. Federal legislation/regulations for special student groups
3. Lack of follow-up studies on students and employers
4. Student demands
5. Time/class size and length of class

Group two:

1. Resistance to change -- individual/institutional
2. Financial resources -- fixed costs/staff costs
3. Lack of uniform and reliable data
4. Communications/definitions
5. Politics -- internal/external influences

Group three:

1. Lack of standard definitions
2. Fear of results
3. Communications/interpretations
4. Lack of realistic data
5. Personnel qualifications and staff coordination

Group four:

1. Lack of uniform cost-effectiveness techniques
2. Lack of adequate in-service training
3. Lack of discretionary funds
4. Fear of manipulation or misinterpretation
5. Inability of organization to respond to cost-effectiveness information

Group five:

1. Lack of time and staff capabilities
2. Fear of results
3. Inability to use the cost-effectiveness system
4. Lack of organizational relationships
5. Inadequate methodology for cost-effectiveness analysis

TABLE V-2

PRIORITY PROBLEMS IN INCREASING COST EFFICIENCY

	Problem Item	Weighting Points	Total
1.	Ignorance of cost efficiency techniques	(2) (5) (3) (4)	14
2.	Class size/enrollment/student recruitment	(1) (4) (3)	8
3.	Lack of adequate budgeting and accounting systems	(5) (2)	7
4.	Cost of data collection/inaccurate data	(4) (3)	7
5.	Political influence	(5) (1)	6
6.	Rigid fiscal procedures	(4) (2)	6
7.	Difficulty in identification of costs	(4) (1)	5
8.	Fear of allocation being cut	(3) (1) (1)	5
9.	Governmental regulations	(5)	5
10.	Lack of understanding of optimal trade-off	(5)	5
11.	Inflation	(3)	3
12.	Fear of manipulation/misinterpretation	(2)	2
13.	Resistance to change	(2)	2

The problems in improving the cost-effectiveness of vocational programs are summarized in the order of weighting points in Table V-3. The five top priority problems are: (1) lack of reliable data/follow-up studies,

(2) fear of results/manipulation, (3) communication/relationship, (4) financial resources/discrepancy, and (5) lack of uniform cost-effectiveness techniques/personnel qualifications (see Table V-3).

TABLE V-3

PRIORITY PROBLEMS IN IMPROVING COST-EFFECTIVENESS OF VOCATIONAL PROGRAMS

	Problem Items	Weighting Points	Total
1.	Lack of reliable data/follow-up studies	(3) (2) (5) (3)	13
2.	Fear of results/manipulation	(4) (2) (4)	10
3.	Communication/relationships	(2) (3) (2)	7
4.	Financial resources/discrepancy	(4) (3)	7
5.	Lack of uniform cost-effectiveness techniques	(5) (1)	6
6.	Personnel qualifications	(5) (1)	6
7.	Resistance to change	(5)	5
8.	Federal regulations/political influences	(1) (4)	5
9.	Inaccuracies in predicting job opportunities	(5)	5
10.	Lack of in-service training	(4)	4
11.	Inabilities to use the cost-effectiveness system/information	(1) (3)	4
12.	Student's demands	(2)	2
13.	Time/class size	(1)	1

To summarize, the top priority problems in the respective developmental strategies are identified as: (1) lack of consensus on goals/definitions/criteria, (2) ignorance of cost efficiency techniques, and

(3) lack of reliable data/follow-up studies. Others frequently mentioned dealt with personnel barriers. Lack of adequate training and the inability of administrators to use cost-effectiveness approaches were thought to be a serious obstacle to change. Another problem was thought to be the administrators' reluctance to change and their fear of the results of change. The group felt that administrators might be afraid of being misunderstood or manipulated by the public as a result of publicized data on the effectiveness and efficiency of vocational programs. Generally it was felt that there was an acute need to train vocational administrators in planning and managerial skills and to develop information systems to improve the effectiveness and efficiency of vocational education programs.

REFERENCES

Delbecq, A.L. & Van de Ven, A.H. A group process model for problem identification and program planning. *Journal of Applied Behavioral Science*, July-August, 1971, 7(4).

Delbecq, A.L., Van de Ven, A.H., & Gustafson, D.H. *Group techniques for program planning: A guide to nominal group and delphi processes*. Glenview, IL: Scott, Foresman and Company, 1975.

CHAPTER VI

DETERMINING PROGRAM OBJECTIVES AND OUTPUTS

Roderick A. McKinney*

Program objectives are defined as specified target goals to be attained by the vocational instructional programs offered at comprehensive high schools or area vocational schools. The model requires that a set of program objectives be formulated by the operating thrusts of vocational administrators at the local school district. At this level, the objectives would be based on state goals and objectives. However, there may be differences in local community demands and student characteristics. Therefore, the objectives should reflect the program needs and requirements of the local district as well as statewide goals and objectives.

It is also assumed that program objectives will be product-oriented and performance based. The model requires that program objectives be related to outcomes anticipated from the program in the local district. Furthermore, program objectives should be subdivided into target goals related to degrees of attainment within the instructional program and expressed in measurable terms.

Cost-effectiveness is not just another dollar and cents approach to program evaluation. The model provides a concept different from that of a

---

*Mr. McKinney is Director of Vocational and Adult Education, Benton Community Area Vocational School, Fowler, Indiana.

program planning budgeting system (PPBS) or one of management by objectives (MBO). The model does provide factors for evaluation, cost analysis, and program comparison, utilizing program objectives and outputs for a comparative analysis in relation to program costs to provide a program performance factor.

Rationale for Determining Program Objectives and Outputs

A set of program objectives is identified for the project. A review of related documents provided sources for a summary of seven objectives of the secondary vocational instructional program. They are as follows:

1. Aid students enrolled in vocational education to successfully complete a secondary occupational program.
2. Assist special student groups to successfully achieve in a secondary vocational program.
3. Provide vocational education for secondary school youth in accordance with their occupational preparation.
4. Provide leadership activities for students enrolled in vocational programs through a youth organization functioning as an integral part of the vocational instruction.
5. Provide guidance and counseling services (career development) information relating to continued education or employment for students enrolled in vocational programs.
6. Provide vocational programs to fulfill the requirements of the labor markets and the employment community manpower needs.
7. Encourage vocational graduates to continue their education after completion of their secondary program.

Each of these program objectives is described in measurable terms as to degrees of its attainment. Furthermore, it is assumed that:

1. Objectives and/or goals for instruction have long been an integral part of vocational education.
2. Vocational education courses are student electives; hence, students have career goals.
3. Vocational education is an accepted part of the secondary education system.
4. Vocational education attempts to match the needs of students, the needs of the business community, and the objectives of the secondary school.
5. Follow-up and placement are considered a part of the total vocational education program.
6. Vocational education provides a source of trained personnel for the business and industrial community.

Indiana Model: Program Objectives and Target Goals

The program objectives and target goal statements are specified in the Indiana cost-effectiveness model which was developed by Dr. Kim and his associates in 1976. The following steps should be taken to determine program target goals, to assess outcomes, and to measure program effectiveness scores.

Step 1. The first step as provided in the Indiana model is to define program objectives and target goals. Desired outcomes and target goals are synonymous in the Indiana model. Program objectives are desired outcomes which are anticipated from an instructional program.

Step 2. Each objective should be reviewed and written in measurable terms. Existing advisory and/or craft committees should be utilized to assist the staff. Advisory committees, craft committees, advisory boards,

students, and staff work together to develop program objectives and target goals. The Indiana model uses seven category objectives. They are:

1. Completion of students from vocational programs.
2. Completion of special student groups from vocational programs.
3. Provision for occupational preparation.
4. Student leadership development.
5. Provision for guidance and counseling services (career development).
6. Fulfillment of labor market requirements and community manpower needs.
7. Advanced education of graduates from secondary vocational programs.

Step 3. The Indiana model selects objectives for each program area. As a part of this selective process, a percent and/or number for each objective is determined.

Step 4. After the completion of the training program, accepted follow-up procedures are used. A follow-up instrument is selected or developed which will provide the information needed to measure the results of vocational student participation in a vocational program.

Step 5. The selection or development of an instrument to collect employers' opinions concerning the adequacy of the vocational training of their employees who have completed the vocational programs.

Step 6. The instruments developed or selected in Steps 4 and 5 are administered to the groups they are intended to measure. The information gathered from the two groups, together with school records, is used to determine the effectiveness of the various instructional programs being studied. The formulas and procedures for computing program effectiveness measures are described in Chapter IX.

Training and Experience at the Indiana State Conference

In June of 1977, a statewide conference on cost-effectiveness analysis of secondary vocational programs was held for Indiana vocational administrators. The objective of the conference was to provide an introduction to a technique by which administrators, their staffs, and advisory groups could develop tools for analyzing cost-effectiveness of their vocational programs. Participants in the conference studied the various measures resulting from the cost-effectiveness analysis, and participated in mini-workshops in order to determine program target goals, analyze program costs, and compute cost-effectiveness measures.

Through group discussion, participants chose a number of target goals and established them in measurable terms. Then they worked on the measurement of program effectiveness by comparing the target goals with actual output information provided by the project staff. In subsequent workshops, participants practiced cost analysis and studied the cost efficiency and performance ratios that are developed in the model.

The workshop activities and resulting measures were then discussed at a general session. Some participants expressed their difficulties in understanding the model, particularly in computing measures and in interpreting the results. It was important for workshop participants to attend the entire program, which presented the information in step-by-step activities. Those arriving late or leaving early would not have received the instruction that they needed to successfully use the techniques contained in the model.

Practical Application

The conceptual model is used to analyze the cost-effectiveness of secondary vocational instructional programs. Two of the major components of the model focus on: (1) objectives/target goals, and (2) outputs generating measures of program effectiveness. A plan should be developed for implementing a cost-effectiveness analysis. The model may be used for one or more vocational programs. A study team may be utilized to develop the study plan and a time schedule of activities. The following questions should be answered in planning a cost-effectiveness study:

1. Why do you need the analysis?
2. What information do you need?
3. What programs will you analyze?
4. What time period will you consider?
5. How will you analyze?

Based upon the answers to the above questions, a study plan can be designed to:

1. determine the types of data needed,
2. check the availability of data,
3. review and/or develop data collection instruments, and
4. set a time frame for the study to include:
    a. definition of program objectives/target goals,
    b. collection of program output data, and
    c. analysis of data.

In implementing the study, the first step is to define program objectives and target goals at the beginning of the school year. The administrator may be responsible for determining target goals for vocational programs. However, it would be wise to organize an advisory committee to pro-

vide the administrator with advice and suggestions for determining program goals.

Program output data can be collected to identify the actual performance in accordance with each target goal. This is the extent to which each target goal is achieved upon completion of the vocational program or after graduation. School records and documents will provide the needed information. Follow-up information concerning the students' training and employment experience may be gathered by mailing a questionnaire form to students one or five years after graduation. Employers' appraisals of vocationally trained employees will provide additional information regarding the quality of output of a given vocational program.

Program effectiveness, then, can be measured by comparing the actual output indicators with the target goals. The resulting measures will provide administrators, decision-makers and teachers with information to evaluate the programs, and will help them to understand the possible reasons for the results.

Summary

The procedures and techniques for determining objectives and outputs present an orderly step-by-step sequence of activities to involve professional and lay people in a decision-making process.

The model recognizes there are local policy and student variations and allows for their analysis by proven accounting procedures.

When the study plan, with its accompanying time schedule, has been developed, professional staff and lay committees have in their hands the tools needed to collect the data required to make decisions. Program ob-

jectives become realistic and measurable when those responsible for a vocational program become involved in the determination of those objectives.

In-school administrators, instructors, and students, working with out-of-school lay people, employers, and personnel directors, will be able to determine objectives and goals which are meaningful and realistic.

CHAPTER VII

ANALYZING PROGRAM COSTS IN VOCATIONAL EDUCATION

Don E. Pennington*

As you may know, cost-effectiveness analysis consists of three elements: (1) program objectives, (2) program outputs, and (3) program costs. The determination of program target goals, along with program outputs constitutes a measure of program effectiveness, that is, the extent to which program objectives have been achieved. The second aspect of cost-effectiveness analysis is cost analysis. This presentation consists of the rationale for analyzing program costs, a cost analysis scheme as developed in the Indiana Cost-Effectiveness Analysis Model, and practical implications of cost analysis for vocational programs.

Rationale for Program Cost Analysis

There has been an increasing interest during the past few years in the expenditures for education. Indiana is not unique in the concern for educational finance that is being expressed by boards of education, school administrators, teachers' unions, state legislators and the general public. Unfortunately, or fortunately, the interests of these various groups are not

---

*Dr. Pennington is Director of Vocational and Adult Education, MSD of Washington Township, Indianapolis, Indiana.

necessarily the same. The problems and priorities of financing education are perceived differently by each group, depending upon their major interests.

The concern for adequate financing is not something new to vocational educators. Expenditures for vocational education have been high at local and state leve's as well as the national level for many years. In recent years, Congress has expressed more interest in the expenditures for vocational education and the results that are being obtained for the dollars spent. Accountability has become a household word for vocational educators. We are being asked to justify our need for dollars by all levels. As we provide a rationale for funding, it is important we recognize that educational efficiency does not necessarily mean conducting education on a least cost basis but, rather, is the achievement of established objectives at the least cost, or the maximization of a given objective within a given cost.

During the past few years, we have been exposed to many systems of administering educational programs. Some of these include management by objectives (MBO), cost-benefit analysis, and planning-programming-budgeting systems (PPBS). Many states have mandated a system of cost accounting and reporting that will identify the specific costs associated with operating programs by level or type of instruction. As an example, our legislature mandated that each school district report expenditures by breaking them down into elementary schools, junior high or middle schools, senior high schools, vocational programs, special education programs, adult education, etc. The expenditures for vocational programs must be reported by program areas such as agriculture, industrial education, distributive education, etc.

Extensive criticism has been expressed by school personnel about the implementation of a cost accounting system that would identify specific program costs. Some of the concerns expressed follow:

1. School districts have insufficient financial resources to develop and implement a cost accounting system.
2. There is insufficient staff time, especially for top administrators, to implement a system.
3. Staff does not understand the concepts associated with a cost accounting system.
4. The staff lacks necessary analytical skills.
5. Such a system would increase the paperwork.
6. The system may require computer time to implement in a large school district.
7. It is difficult to get the educational community to think in terms of cost effectiveness.
8. The guidelines from the state and/or national offices will not meet local needs; therefore, local officials will only go through the motions.
9. The program objectives will be established without the involvement and commitment of subordinates.
10. The system will be thought of as an end in itself rather than a means to an end.
11. The system will be treated as decision making rather than as a tool of decision makers.
12. The system will be seen as a tool of the top level by the lower level and result in a lack of commitment on the part of subordinates.
13. The public will see the system as a way to provide output information while school personnel will focus upon input information.
14. Teachers may view the system as an intrusion upon their academic freedom.

Although many of these are legitimate concerns, we must realize that our problem is to overcome such barriers. In most cases, we are being re-

quested and/or mandated to implement a cost analysis system that will identify the costs of providing specific educational programs. As vocational educators, it is imperative that we provide the leadership for the development of a system that depicts results obtained with expenditures, rather than expenditures alone.

Vocational administrators have been identifying program costs for many years. Because of limited resources, it has been necessary to analyze program costs in order to use the available resources in the most efficient and effective manner.

Although we have had cost data available, it has not necessarily been meaningful data. The basis for determining program costs have varied from one state to another and one local district to another. As an example, a few years ago the average program costs for the area vocational schools in this state ranged from a low of less than $300 to more than $900 per student. Admittedly, there is some difference in the cost of operating vocational programs depending upon the local area. Salaries, utilities, transportation, and other costs vary from one community to another, but not to the degree cited in the previous example. The major reason for this wide variation in program costs was a result of the different means by which the costs were determined. School districts did not use the same bases for determining costs. There was no consistency from one vocational school to another in what was included in determining the cost of a program. For example, one school may have considered building and equipment depreciation as a program cost while another school did not. It was apparent, given such conditions, that a system for cost analysis should be developed that would result in reliable program cost data.

Indiana Model: Program Cost Analysis

Program costs, as a part of the Indiana cost-effectiveness analysis model, are defined as annual expenditures for operating the vocational instructional programs at the local level. Expenditures are analyzed on the basis of yearly operating costs rather than multi-year costs.

As recommended in the U.S. Office of Education Accounting Handbook, program costs can be divided into two types of expenditures -- direct and indirect.

Direct costs consist of expenditures directly related to the instructional program -- those costs that can be specifically identified for the operation of a program. Direct costs include items such as:

1. Salaries of instructional staff
2. Fringe benefit costs for instructional staff
3. Program travel costs
4. Costs for instructional supplies and materials
5. Equipment purchases
6. Equipment depreciation
7. Building use cost
8. Other identified costs

The direct costs are charged to the specific program for which they occurred during the year.

Indirect costs are expenditures for supporting services that cannot be tied to a specific program. These expenditures are prorated among the various programs. Indirect costs include such items as:

1. Student support services: Activities which are designed to assess and improve the well-being of students and supplement the teaching process;

2. Instructional staff services: Activities associated with assisting the instructional staff in the teaching process:

3. General administration services: Activities associated with establishing and administering policy in connection with operating the school corporation (district);

4. School administration services: Activities concerned with overall administrative responsibility for school operation;

5. Business services: Activities related to purchasing, paying, transporting, exchanging, and maintaining goods and services for the school corporation; and

6. Central support services: Activities, other than general administration and business services, which support each of the other instructional and supporting services.

There are many methods of prorating indirect costs, but it is important that these expenditures be prorated on the basis of appropriate criteria. The U.S. Office of Education Accounting Handbook states the most common methods have for a bases either: (1) time, (2) average daily membership or average daily attendance, (3) time - space, (4) time consumption, (5) number of students, (6) mileage, (7) units consumed, (8) employees, (9) number of transactions, or (10) dollars.

The selection of one basis over another in prorating expenditures will depend on the types of supporting services. One of the most important considerations in selecting a method for prorating expenditures is that it has a direct relationship to the activity for which the expenditure is being prorated.

Also important in selecting a method for prorating are the practical considerations involved. The method must be as simple as conditions will allow, and it must be feasible to apply.

No single method will suffice for prorating the many different kinds of expenditures involved in school finance. For some activities, such as administrative salaries, average daily membership or average daily attendance may be the most satisfactory prorating method. For other activities, like custodial and maintenance salaries, floor area may be the most satisfactory method.

It should be emphasized that proration is not being recommended as a substitute for identifying the actual, or direct, expenditures for programs when such is feasible. However, when it is necessary to prorate expenditures, a method should be selected that will result in meaningful cost data.

Once the indirect costs have been prorated to a specific vocational program, they can be added with the direct costs to indicate the total cost of operating the program.

Practical Implications

The preceding is a system for cost analysis which was presented as one part of the cost-effectiveness model. The amount of cost data required will be a function of the decision situations as well as the purposes of the cost-effectiveness analysis. It is imperative that the system be designed to provide the data needed to arrive at meaningful and realistic program decisions.

Cost analysis is an important function in the operation and administration of schools. Without an adequate system to indicate what has happened or is happening in an educational program, management decisions and policies would have to be based on memory or guesswork. With an adequate system for cost analysis, intelligent and informed decisions can be made.

A cost analysis system must be developed and maintained on a consistent and systematic basis to provide information and service to many different groups such as:

1. The local boards of education, superintendents, business managers, vocational administrators, etc., all of whom need information to manage the educational program.

2. The residents and taxpayers of the educational community who provide the local finances which are used to operate the programs.

3. Representatives of many different governmental agencies such as the state department of education and the federal government, each of which needs specific kinds of information in order to carry out its responsibilities.

The development and implementation of a system for cost analysis will further refine many services or functions needed for effective administration of vocational programs. Some of these include:

1. Maintenance of an accurate record of the financial activities involved in the operation of programs.

2. Provision for a system to insure that the available resources will be used for the benefit of the students.

3. Effective planning by administrators.

4. Facilitation of an analysis of the use of the financial resources with emphasis on the requirements and educational policies inherent in the budget.

5. Reports by the school district to various local, state, and national groups concerning the financial aspects of the programs.

Finally, the system for cost analysis may differ according to the needs and purposes, but a model system should adhere to the following criteria:

1. The system should provide reliable financial and related operational information for all interested parties.

2. The system should be accurate and provide a reasonable degree of internal control. If so designed, it will automatically assist those involved in the administration of the programs.

3. The system should be consistent with generally accepted governmental accounting principals, and be consistent between one period of time and another. Valid comparisons can be made only if the items are treated in the same manner.

4. The system should be flexible. Change is inevitable. New programs will develop; old programs will be dropped. Provisions should be made for taking care of changes with as little disruption as possible.

5. The system should be uniform. To permit maximum usefulness, it should allow for financial, operational, or performance comparisons.

6. The system should be as simple as possible and still fulfill the pertinent requirements. It is essential that the system not become merely frustrating "busy" work. It should help to improve the educational processes, not hinder them.

7. The system should provide ready access to information about individual programs.

CHAPTER VIII

COMPUTING THE COST-EFFECTIVENESS MEASURES FOR VOCATIONAL EDUCATION PROGRAMS

Jin Eun Kim*

In recent years, management science has developed new management systems such as accountability, planning-programming-budgeting (PPB), and management by objectives (MBO). These systems are helpful in the management of vocational programs. Although each of the approaches emphasizes specification of program objectives, measurement of objective attainments, and efficient utilization of resources, few attempts have been made to provide applicable formulas and quantitative measures for assessing educational and managerial performance in vocational education.

In an effort to alleviate this problem, the Indiana Cost-Effectiveness Model attempted to generate three kinds of cost-effectiveness measures for vocational programs. This paper describes: (1) the rationale for the use of cost-effectiveness analysis in relation with the management systems, (2) formulas and procedures for computing cost-effectiveness measures, and (3) interpretation and utilization of the measures for vocational program evaluation and planning.

Rationale for Cost-Effectiveness Analysis

As a systems analysis, the cost-effectiveness analysis technique is related to the accountability, PPB, and MBO systems. The relationships of

---

Dr. Kim is Assistant Professor and Project Director, Cost-Effectiveness Analysis Studies in Vocational Education, Indiana University-Bloomington.

the technique with these systems are described in terms of three common elements which are fundamental to all these management systems.

Concepts of Cost-Effectiveness Analysis

The cost-effectiveness technique is an analytic, evaluative, and planning tool which relates the total effectiveness of a program to its total costs. In other words, it is a technique for assessing the outputs of programs relative to their objectives and in terms of the costs of these programs (Kim & Harris, 1976).

Quade (1967) defines cost-effectiveness analysis broadly as an "analytical study designed to assist a decision-maker in identifying a preferred choice among possible alternatives" (p. 1). He finds five components to the analysis: (1) the objectives, (2) the alternative ways in which the objectives might be attained, (3) the costs, (4) a model or simplified representation of the situation to be analyzed, and (5) a criterion or standard by which to rank the alternatives in order of desirability and to choose the most promising one (pp. 4-5).

As applied to schools, the technique has been described as "the process of solving problems of choice requiring the definition of measurable objectives, identification of alternative ways of achieving the objective, identification of the anticipated cost and effectiveness for each alternative, and identification of the optimum alternative which potentially achieves the desired objectives for the educational activities of a school" (Cary, 1972, p. 61). Knezevich (1973) views cost-effectiveness analysis as a series of activities: (1) specifying objectives, (2) identifying alternative means, (3) generating a model for the program under study,

(4) computing the costs (disadvantages) for each alternative means to an objective, (5) determining the effectiveness (advantages) for each alternative, (6) computing the ratios between cost and effectiveness for each alternative plan, (7) adopting a criterion, that is, a rule or standard to be used for ranking and selecting alternative means to an objective, and (8) recognizing the importance of iterative processes for confirming refinement of the analysis (p. 185).

In summary then, cost-effectiveness analysis is the systems analysis process which includes goal definition, alternative development, alternative trade-off studies, and alternative selection (Heaton, 1969, p. 35). As a systems analysis, cost-effectiveness analysis is relevant to management systems such as the accounting system, the PPB system, and the MBO system.

Accountability and Cost-Effectiveness Analysis

Accountability is defined in many different ways: as performance reporting, a technical process, a political process, or an institutional process (Levin, 1974, p. 364). Essentially, it establishes "who is accountable for what and to whom." Vocational administrators are held accountable for improving program effectiveness and efficiency by students, legislators, and taxpayers to whom they should be able to report the answers to these seven interrelated questions: (1) What is to be achieved? (2) Who is responsible? (3) What was actually achieved? (4) What resources were used to achieve the results? (5) What techniques were available? (6) What steps were taken to get the intended results?, and (7) What will happen in the future? (Lessinger, 1977, p. 151).

From the management perspective, the accountability concept places emphasis on the attainment of objectives as well as on the allocation of

resources. As a means of getting top results, an accountability system demands a careful specification of objectives, an assignment of responsibilities, and a subsequent measurement of achievements (Knezevich, 1973, p. 59). It is thought that such a system will enable a school district to reach acceptable levels of performance and continuously improve its services (DeMont & DeMont, 1975, p. 6). Before schools may be held accountable for results, each school must have a structure which allows it to monitor its own performance in terms of costs and results (Lessinger, 1977). For this purpose, the accountability system requires both the effectiveness and efficiency measures derivable from the cost-effectiveness analysis.

PPB System and Cost-Effectiveness Analysis

Cost-effectiveness analysis has significant applications to the PPB system. PPB, or as it is sometimes called, program budgeting, was originally developed for federal program management with emphasis on strategic planning and the role of analysis in the budgeting process. Fisher (1971) discussed three aspects of the PPB system: (1) the structural aspect, oriented primarily toward an end product or end objective, (2) analytical process considerations, for the examination of alternative courses of action, and (3) information system considerations, for evaluation and control.

To apply the PPB system to education, Knezevich (1973) developed the PPBADERS cycle of activities: (1) Planning, for clarifying goals, (2) Programming, for generating alternative approaches to goals, (3) Budgeting, for translating programs into fiscal requirements, (4) Analyzing,

for determining the cost-effectiveness of alternatives, (5) Deciding the best course of action, (6) Evaluating outcomes and relating each to prior expectations, and (7) Recycling, for feeding evaluative judgments into the system to begin a new and modified PPBADER cycle. This cycle concept not only shows the relationship of cost-effectiveness analysis to the PPB system, but also clarifies its role in evaluating and planning educational programs.

Thus, cost-effectiveness analysis is a useful addition to the PPB system and increases its potential by providing decision makers with information on program effectiveness and cost implications in achieving the stated objectives.

MBO and Cost-Effectiveness Analysis

The management by objectives (MBO) concept was originally developed by Drucker as a management technique to direct the vision and efforts of all managers toward a common goal. According to his book (1954), each manager should be responsible for developing the objectives of his unit as well as for participating in the development of the higher units' objectives. Furthermore, every manager should be able to measure his own performance and results against the stated goal, have sufficient information to measure his own performance, and receive it soon enough to make any changes necessary for the desired results (pp. 121-136).

Schrieber and Sloan (1970) viewed management by objectives as a management process by which work is organized in terms of achieving specific objectives by set times, and in which the superior and subordinate jointly:

1. Identify in writing major functional areas of responsibility for the subordinate, including objectives to be accomplished in terms of results, and

2. Determine how and by what time these standards should be achieved, so that the superior and the subordinate periodically evaluate progress (p. 20).

With primary emphasis on the management functions of planning and controlling, Morrisey (1970) devised a management by objectives and results (MOR) approach which consists of ten stages: (1) determining the baseline of work to be performed, (2) forecasting the future, (3) setting objectives to be achieved, (4) programming to follow in reaching objectives, (5) scheduling for objectives and programs, (6) budgeting to reach objectives, (7) establishing standards for effectiveness performance in achieving objectives, (8) determining actual versus planned performance, (9) taking corrective action toward performance improvement, and (10) achieving objectives. This process covers the accountability and PPB concepts by dealing with the planning and evaluation functions of management.

Knezevich (1973) examined MBO, first, from the behavioral scientists' viewpoint as a method of evaluating individual job performance, improving worker's motivation, and increasing people's sensitivity to one another; secondly, he examined it as a systems management technique which stresses specification of objectives and organization of resources toward their achievement. The latter concept of MBO is viewed as a subset of the PPB system and is a kind of accountability technique for holding people responsible for results (pp. 53-57). Thus, as a planning and control approach, an MBO system requires analytical techniques and measures for assessing performance achievements.

Relationship of the Four Concepts

The concept of accountability, in a broad sense, links the PPB and MBO system, both of which use analytical techniques to derive quantitative

measures from cost-effectiveness analysis. There are three common elements to the four concepts. They are: (1) specified objectives and target goals, (2) resulting outputs, and (3) enumeration of costs. The relationship is diagrammed in Figure VIII-1.

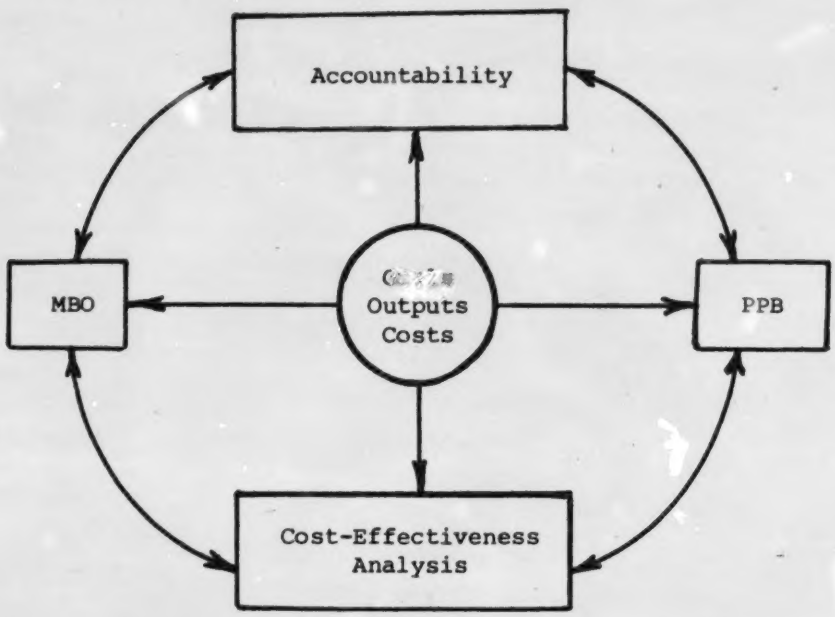


Figure VIII-1

The Relationship of the Four Concepts of Accountability
MBO, PPB, and Cost-Effectiveness Analysis

Each of the three elements may be described in measurable terms and quantified to compute the degrees of effectiveness, efficiency, and managerial performance in vocational education. Thus, specification of the three analytical elements and computation of three kinds of measures are extremely important in the application of PPB and MBO to local school systems for the improvement of their management system.

Indiana Model: Cost-Effectiveness Measures

In developing the Indiana Cost-Effectiveness Analysis Model, emphasis was placed on the specification of goals, outputs, and costs of vocational programs, and their analysis by means of three cost-effectiveness measures: (1) program effectiveness, (2) cost efficiency, and (3) cost-effectiveness ratio and performance ratio. The formulas and computing procedures for these measures are described below (Kim & Harris, 1976, pp. 60-62).

Program Effectiveness

First, effectiveness is defined as a measure of the achievement of program objectives. Accordingly, program effectiveness is measured by the degree of target goal attainment.

Program effectiveness (PE_i) scores are computed by dividing the actual outputs (O_i) by the expected target goals (G_i), or

$$PE_i = \frac{O_i}{G_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

For instance, if 100 percent of the enrollees were expected to complete a program, but 90 percent actually completed the program, the effectiveness score of the program would be 90 percent.

Furthermore, a Composite Program Effectiveness (CPE) index is computed by adding all available effectiveness scores. Dividing the composite index by the number of effectiveness scores (N) provides an Average Program Effectiveness (APE) index. The expression of the CPE and APE indexes is as follows:

$$CPE = \sum_{i=1}^{n} \frac{O_i}{G_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$APE = \frac{\sum_{i=1}^{n} \frac{O_i}{G_i}}{N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

If each program is weighted on the basis of policy preferency or by the importance of program objectives, a Weighted Composite Program Effectiveness (WCPE), and a Weighted Average Program Effectiveness (WAPE) index can be made as follows:

$$WCPE = \sum_{i=1}^{n} \frac{O_i}{G_i} \cdot W_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

$$WAPE = \frac{\sum_{i=1}^{n} \frac{O_i}{G_i} \cdot W_i}{\sum_{i=1}^{n} W_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Cost Efficiency

The efficiency of a program is a function of the relationship between cost and output. In general, the term *unit cost* refers to "resources consumed for a unit of output" (Knezevich, 1973, p. 162). The Indiana model computes unit costs as efficiency measures by dividing total costs of the program by units of the outputs, such as total number of program completions or graduates. Unit cost per student or per student contact hour results from a division of total program costs by the total number of students enrolled in the program or by total number of student contact hours within the program

(Molner, 1973; Harris & O'Fallon, 1974). Thus, Actual Cost Efficiency ($CE_{(a)}$) measures are computed by dividing Actual Total Cost of the Program ($C_{(a)}$) by units of outputs such as total number of completions (O_1), the number of students enrolled in the program (O_2), or the number of student contact hours (O_3). Each of the products is called Actual Unit Cost ($UC_{(a)}$) and is expressed:

$$CE_{(a)} = \frac{C_{(a)}}{O_1}, \frac{C_{(a)}}{O_2}, \frac{C_{(a)}}{O_3} \text{ or } UC_{(a)} \quad \ldots\ldots\ldots\ldots (6)$$

By analyzing budget costs for vocational programs, Budgeted Cost Efficiency ($CE_{(b)}$) measures may be made in the same way as in Formula 6, above. They are expressed:

$$CE_{(b)} = \frac{C_{(b)}}{O_1}, \frac{C_{(b)}}{O_2}, \frac{C_{(b)}}{O_3} \text{ or } UC_{(b)} \quad \ldots\ldots\ldots\ldots (7)$$

Furthermore, a Cost Efficiency Index (CEI) can be derived from the division of actual total or unit cost by budgeted total or unit cost for the vocational instructional program. If average or standardized unit cost information is available, the actual unit cost may be compared with it to produce a cost efficiency index. By comparing (6) with (7), a Cost Efficiency Index (CEI) is computable:

$$CEI = \frac{C_{(a)}/O_1}{C_{(b)}/O_1}, \frac{C_{(a)}/O_2}{C_{(b)}/O_2}, \frac{C_{(a)}/O_3}{C_{(b)}/O_3} \text{ or } \frac{UC_{(a)}}{UC_{(b)}} = \frac{C_{(a)}}{C_{(b)}} \quad \ldots (8)$$

Cost-Effectiveness Ratio and Performance Ratio

Finally, by utilizing the measures of program effectiveness and cost efficiency, cost-effectiveness and performance ratios can be computed. A Cost-Effectiveness Ratio (C/ER) is prepared as below:

$$C/ER = \frac{(2),\ (3),\ (4),\ \text{or}\ (5)}{(6)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

The ratio indicates the degree of goal attainments per unit cost. This cost-effectiveness ratio computation is somewhat different from the commonly used method of dividing outputs by the total or unit costs as inputs (Knezevich, 1973, p. 204; Handbook II, 1973, p. 70). That method lacks the effectiveness measures defined in this paper; therefore, it may be seen as the calculation of a cost-output ratio rather than a cost-effectiveness ratio.

A Performance Ratio (PR) is the result of the division of program effectiveness by the cost efficiency index, as follows:

$$PR = \frac{(2),\ (3),\ (4),\ \text{or}\ (5)}{(8)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

It indicates more or less than one unit, using the average program effectiveness index. Also, it is a precise index which measures the relationship between program effectiveness and cost efficiency.

Interpretation and Utilization

After the cost-effectiveness measures are computed and interpreted, they can be used in the decision-making process for program evaluation, development, and planning.

Interpretation of Cost-Effectiveness Measures

The mathematical results seem to be simpler to deal with than the situations which produced them. But the results should be interpreted carefully. When interpreting program effectiveness measures, the following

points should be taken into consideration:

(1) Were program objectives appropriately selected?

(2) Were target goals adequately determined?

(3) Which effectiveness measures are most reliable?

In interpreting cost efficiency measures, the following questions are critical:

(1) Which items were considered costs for a vocational program?

(2) How were costs prorated to the program?

(3) Which efficiency measures are most reliable?

A cost-effectiveness ratio is a criterion for judging program effectiveness relative to its costs. A performance ratio is a measure of management performance based on program effectiveness and cost efficiency. For a comparison of two or more programs within a school or between schools, cautious consideration should be given to the following additional points:

(1) Are effectiveness scores and indices computed from the same target goals?

(2) Are efficiency measures and indices computed from the same cost items?

(3) Are the students and their community backgrounds comparable?

The interpretation of cost-effectiveness measures can provide answers to the following questions:

(1) How effective is the program?

(2) How efficient is the program?

(3) How are program effectiveness and cost efficiency related?

When two or more programs are compared, answers to the following questions result:

(1) Which program is most effective?

(2) Which program is most efficient?

(3) Which program is most effective and efficient?

By analyzing the study results, it is possible to determine whether:

(1) Program effectiveness should be increased with the given resources, or

(2) Additional resources should be allocated to the most effective and/or efficient programs.

Utilization of Cost-Effectiveness Measures

First, cost-effectiveness measures can be used for program evaluation purposes. Programs may be ranked in the order of their effectiveness and/or efficiency. Also, it is possible to identify factors which influence program costs and to explain the relationship between program effectiveness and costs. Thus, the measures can help administrators make wiser decisions about improving program effectiveness and/or cost efficiency and developing new programs.

Further, these measures will provide a basis for planning vocational education programs. Based on the program evaluation, a short-range (one or two-year) plan should be developed for increasing program effectiveness and/or cost efficiency, and a long-range (five-year) plan should be made which will implement strategies for the improvement of overall vocational programs as well as the development of new vocational programs.

Summary

Cost-effectiveness analysis is an analytical technique for assessing outputs of vocational programs in relation to program objectives in terms of the associated program costs. The technique can be integrated into existing

management systems such as the accountability, PPB and MBO systems. Specification of three common elements and computation of performance measures are extremely important in developing the management systems.

The Indiana Cost-Effectiveness Analysis Model placed emphasis on the specification of program objectives, outputs, and costs by generating three kinds of cost-effectiveness measures for vocational education programs. Ten formulas developed in the model will be useful for computing the measures of program effectiveness, cost efficiency, and managerial performance.

These measures can be used for evaluating and planning vocational programs. Applied continually and in connection with appropriate information in the decision-making process, they will help administrators provide improved programs at lower costs.

REFERENCES

Cary, F.G. *Development of an instructional cost-effectiveness analysis model for use in school districts*. Unpublished doctoral dissertation, State University of New York, 1972.

DeMont, B., & DeMont, R. *Accountability: An action model for the public schools*. Homewood, IL: ETC Publications, 1975.

Drucker, P.F. *The practice of management*. New York: Harper and Row, 1954.

Fisher, G.H. The role of cost-utility analysis in program budgeting. In F.J. Lyden & E.G. Miller (Eds.), *Planning-programming-budgeting: A systems approach to management*. Chicago: Markham Publishing Company, 1971.

Harris, G.W., & O'Fallon, K. *Cost analysis of secondary school vocational technical education programs*. Knoxville, TN: Tennessee University, Bureau of Educational Research and Services, June 1974. (ERIC Document Reproduction Service No. ED 080 897 CE 000 117)

Heaton, D.H. Systems/cost-effectiveness analysis in the system engineering process. *Defense Industry Bulletin*, 1969, 5(7).

Kim, J.E., & Harris, R.C. *A cost-effectiveness analysis model for secondary vocational programs*. Bloomington, IN: Indiana University, 1976. (ERIC Document Reproduction Service No. ED 130 081, CE 008 487)

Knezevich, S.J. *Program budgeting (PPBS) in education*. Berkley, CA: McCutchan, 1973.

Lessinger, L.M. Accountability, productivity, and control. *The High School Journal*, January 1977, 60(4), 151-157.

Levin, H. A conceptual framework for accountability in education. *School Review*, May 1974, No. 3, pp. 363-389.

Molnar, D.E. *Cost-effectiveness of selected cooperative vocational education programs as compared with vocational programs without a cooperative component. Final report*. Columbus, OH: Battelle Memorial Institute, 1973. (ERIC Document Reproduction Service No. ED 080 671, VT 020 629)

Morrisey, G.L. *Management by objectives and results*. Reading, MA: Addison-Wesley Publishing Company, 1970.

Quade, E.S. Introduction and overview. In T.A. Goldman (Ed.), *Cost-effectiveness analysis: New approaches in decision-making*. New York: Frederick A. Braeger, 1967.

Schrieber, D.E., & Sloan, S. Management by objectives. *Personnel Administrator*, May-June 1970, 15, 20-26.

REFERENCES, continued

U.S. Office of Education. *Financial accounting: Classifications and standard terminology for local and state school systems, handbook II.* (Rev. ed.). Washington, DC: U.S. Government Printing Office, 1973.

CHAPTER IX

SMALL GROUP WORKSHOPS FOR COST-EFFECTIVENESS ANALYSIS

This chapter presents small group workshop guidelines for cost-effectiveness analysis of vocational programs and the resulting measures from the analysis.

Guidelines for Group Workshops

Small group workshops focus on determination of program target goals, analysis of program costs, and computation of cost-effectiveness measures. Guidelines for each group workshop are described below. Target goal statements, hypothetical information, and data forms can be found in the Appendix.

Group Workshop (1): Target Goals Determination

The purpose of the first group workshop is to determine program objectives and target goals during a ninety minute period, under the guidance of the group leader. For this purpose, group members are provided with a set of program objectives and target goal statements, and hypothetical information on a high school corporation.

The workshop will assist the participants in increasing their abilities to:

1. Identify the need for writing program objectives in measurable terms.
2. Develop a set of program objectives for determination of specified target goals of vocational programs.

3. Consider program importance, policy preferences, and data availability in writing objectives.

4. Determine the importance of each of the target goals.

Some procedural activities suggested for the participants are to:

1. Review a set of program objectives and target goal statements (see Appendix A) and hypothetical information on a high school corporation (see Appendix B).

2. Select a number of target goal statements from among the seven objective categories, considering program importance and data availability.

3. Identify appropriate target goals with future perspective.

4. Determine the priority of each of the selected goals.

Group Workshop (2): Cost Analysis

The second workshop focuses on analyzing program costs for instructional and supporting services; it also lasts ninety minutes. The objectives of the workshop are to classify cost data into direct and indirect categories to be analyzed, and to compute direct costs, indirect costs, and total costs for vocational programs.

The following procedures are suggested for use of the program cost analysis form with given data (see Appendix C).

1. Identify the following item costs for a program and sum. These will be the direct costs for instruction:

   (1) Salaries of teaching staff
   (2) Fringe benefits
   (3) Travel costs
   (4) Supplies and materials
   (5) Costs of equipment and furniture
   (6) Building use costs

2. Prorate current expenditures for the following supporting services to vocational programs by using appropriate allocation bases:

   (1) Student support services
   (2) Teaching staff services
   (3) Central administration support services
   (4) School administration support service
   (5) Plant operation and maintenance
   (6) Central support service

3. Compute indirect costs by adding all supportive service costs.

4. Calculate total costs for vocational programs.

Group Workshop (3): Cost-Effectiveness Measurement

The third workshop is designed for group members to compute cost-effectiveness measures for vocational programs during a ninety minute period. For this purpose, group members are provided with hypothetical program output data (see Appendix D). Through the workshop, the group members will be able to:

1. Compute program effectiveness scores for vocational programs.

2. Draw program effectiveness indices.

3. Compute unit costs and prepare a cost efficiency index.

4. Compute a cost-effectiveness ratio and a performance ratio for vocational programs.

The procedures and formulas for computing the cost-effectiveness measures are as follows (see Chapter VIII, pp. 118-121):

1. Compute program effectiveness (PE) score expressed as a percent of goal attainment: PE (%) = Output/Goal x 100. A program effectiveness score can be computed by dividing output indicator by corresponding target goal.

2. Weighted effectiveness scores can be prepared by multiplying each effectiveness score by the weighting points which are given to each target goal.

3. Draw program effectiveness indices as follows:

   (1) Composite Program Effectiveness (CPE): a sum of all effectiveness scores
   (2) Average Program Effectiveness (APE): a sum of effectiveness scores/number of scores
   (3) Weighted Composite Program Effectiveness (WCPE): a sum of weighted effectiveness scores
   (4) Weighted Average Program Effectiveness (WAPE,. a sum of weighted effectiveness scores/total number of weighting points

4. Compute unit costs for vocational programs as below:

   Cost per enrollment: total program cost/total number of enrollments within the program

5. Compute a Cost Efficiency Index (CEI) by means of the formula below:

$$CEI = \frac{\text{Actual Unit Cost}}{\text{Budgeted or Average Unit Cost}}$$

6. Draw a cost-effectiveness ratio (C/ER) by dividing a program effectiveness index by actual unit cost per enrollment as follows:

$$\text{C/E Ratio} = \frac{\text{Program Effectiveness: APE or WAPE}}{\text{Actual Unit Cost Per Enrollment}}$$

7. Draw a performance ratio (PR) by dividing program effectiveness by cost efficiency index (CEI) as follows:

$$PR = \frac{\text{Program Effectiveness: APE or WAPE}}{\text{Cost Efficiency Index (CEI)}}$$

Results of Small Group Workshops

At the national workshop, each group member practiced the determination of program target goals, the analysis of program costs, and the computation

of cost-effectiveness measures for a vocational program assigned to their group. Each group presented their results to the entire group for discussion. The results of the group workshops are illustrated below.

Program Target Goals and Effectiveness Measures

At the first workshop, each group selected the target goals from the Program Objectives and Target Goal Statements (see Appendix A) and determined numerical levels in accordance with codes of the selected goals. The determined target goals, matched actual outputs, effectiveness scores, weighting points, and weighted effectiveness scores are shown in Table IX-1.

Table IX-1

PROGRAM TARGET GOALS AND EFFECTIVENESS MEASURES
USING HYPOTHETICAL DATA

Program	Code	Target Goal	Actual Output	Effectiveness Score (%)	Weighting Point	Weighted Score
Auto Body	1-b	70%	45%	64.3	20	1,286
	2-c	15	12	80.0	10	800
	2-e	10	10	100.0	10	1,000
	2-g	20%	10%	50.0	10	500
	3-a	85%	80%	94.1	50	4,705
	4-a	100%	90%	90.0	20	1,800
	5-c	80%	50%	62.5	20	1,250
	6-a	80%	60%	75.0	25	1,875
	6-d	15	10	66.7	25	1,668
	7-c	90%	80%	88.9	10	889
Data Processing	1-b	75%	40%	53.3	20	1,066
	2-b	15%	15%	100.0	30	3,000
	3-a	100%	80%	80.0	25	2,000
	3-c	80%	60%	75.0	25	1,875
	4-a	75%	70%	93.3	20	1,866
	5-c	80%	70%	87.5	20	1,750
	6-a	50%	50%	100.0	25	2,500
	6-b	60%	50%	83.3	25	2,082
	7-a	25%	20%	80.0	5	400
	7-b	90%	80%	88.9	5	445

TABLE IX-1, continued

Program	Code	Target Goal	Actual Output	Effectiveness Score (%)	Weighting Point	Weighted Score
Horticulture	1-b	70%	40%	57.1	10	571
	1-e	80%	60%	75.0	10	750
	2-a	10%	10%	100.0	15	1,500
	2-b	20%	20%	100.0	15	1,500
	3-a	80%	75%	93.8	25	2,345
	3-f	80%	60%	85.7	25	2,142
	4-a	100%	90%	90.0	20	1,800
	5-c	60%	50%	83.3	20	1,666
	6-a	90%	80%	88.9	50	4,445
	7-a	15%	15%	100.0	10	1,000
Health Occupations	1-b	90%	70%	77.8	10	778
	1-c	100%	90%	90.0	10	900
	2-b	30%	25%	83.3	15	1,250
	2-g	30%	20%	66.7	15	1,000
	3-a	90%	90%	100.0	50	5,000
	4-a	80%	70%	87.5	20	1,750
	5-c	70%	60%	85.7	20	1,714
	6-a	80%	70%	87.5	50	4,375
	7-a	15%	10%	66.7	5	334
	7-c	90%	80%	88.9	5	445
Distributive Education	1-b	90%	75%	83.3	10	833
	1-c	100%	80%	80.0	10	800
	2-a	5%	5%	100.0	15	1,500
	2-b	25%	20%	80.0	15	1,200
	3-b	70%	65%	92.9	25	2,322
	3-h	80%	65%	81.2	25	2,030
	4-a	100%	95%	95.0	20	1,900
	5-a	70	60	85.7	20	1,714
	6-a	70%	65%	92.9	50	4,645
	7-a	10%	10%	100.0	10	1,000

Program effectiveness scores (%) are computed by dividing actual outputs by target goals and multiplying the products by 100. Each program effectiveness score is multiplied by weighting points based on importance of policy to produce the weighted score.

Program effectiveness indices are computable. The composite effectiveness index is the sum of all effectiveness scores for one vocational program, and the average effectiveness index is computed by dividing the composite effectiveness index by the number of effectiveness scores. The composite weighted effectiveness index is the sum of all weighted effectiveness scores, and the average weighted effectiveness scores are computed by dividing the composite weighted effectiveness index by the total number of weighting points. The results are shown in Table IX-2.

TABLE IX-2

PROGRAM EFFECTIVENESS INDICES

Index	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
Composite Effectiveness Index	771.5	841.2	873.8	834.1	891.0
Average Effectiveness Index	77.2	84.1	87.4	83.4	89.1
Weighted Composite Effectiveness Index	15,773	16,984	17,719	17,546	17,944
Average Weighted Effectiveness Index	78.9	84.9	88.6	87.7	89.7

Program Costs and Cost Efficiency Measures

Following the guidelines for program cost analysis, direct and indirect costs may be calculated and the total costs computed. The actual unit cost for the vocational program is computed by dividing the total costs by the number of students enrolled. Dividing the actual unit cost by average or budgeted unit cost produced a cost efficiency index. Table IX-3 contains a program costs and cost efficiency index for vocational programs.

TABLE IX-3

PROGRAM COSTS AND EFFICIENCY INDEX BASED ON HYPOTHETICAL DATA

	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
Total Costs ($)	61,050	97,570	54,614	37,782	58,365
Direct Costs ($)	48,205	83,395	42,190	29,985	42,770
Indirect Costs ($)	12,845	14,175	12,424	7,797	15,595
Number of Enrollments	45	60	50	35	70
Actual Cost per Enrollment ($)	1,357	1,626	1,092	1,079	834
Average of Budgeted Cost per Enrollment ($)	1,100	1,500	1,200	1,000	900
Cost Efficiency Index	1.23	1.08	.91	1.08	.93

Cost-Effectiveness Ratio and Performance Ratio

The average weighted effectiveness index of the program is compared with the unit cost per enrollment to produce a cost-effectiveness ratio, and performance ratio is computed by dividing the average weighted effectiveness index by the cost efficiency index. The results are shown in Table IX-4.

Throughout the small group workshops, cost-effectiveness measures provided information calculated to answer three questions: (1) Is the program effective? (2) Is the program efficient?, and (3) Is the program effective and efficient? In our example, Data Processing and Health Occupations programs are effective but less efficient, Horticulture and

Distributive Education programs are effective and efficient, and the Auto Body program is less effective and less efficient. Thus, the three kinds of cost-effectiveness measures can be used as criteria in determining the degrees of effectiveness, efficiency, and performance of vocational programs. They can help vocational administrators to: (1) increase program effectiveness using the resources at hand, and/or (2) allocate additional resources to the most effective and efficient programs.

TABLE IX-4

COST-EFFECTIVENESS RATIO AND PERFORMANCE RATIO

	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
Cost-Effectiveness Ratio	.058	.052	.081	.081	.108
Performance Ratio	64.146	78.611	97.363	81.203	96.452

However, these results should not be used for comparison among the programs unless the effectiveness scores and indices are based on the same goals and efficiency measures are based on the same cost items in all programs. The measures should be carefully interpreted and consideration given to the factors influencing the results, and there should be an attempt made to identify other possible reasons for the results.

CHAPTER X

SUMMARY AND CONCLUSIONS

This handbook contains six papers and describes the process and results of small group activities. The first three strategy papers focus on: (1) improving program effectiveness, (2) increasing cost efficiency, and (3) improving cost-effectiveness of vocational programs.

Lois-ellin Datta discusses the need for process evaluation, various causes of ineffectiveness, and planning for program information. To improve the effectiveness of vocational programs, she suggests four general strategies: (1) changing the nature of the population served, (2) changing the program, (3) changing the environment in which the program is operated, and (4) leaving the program alone.

James Pershing examines some ideas on increasing the cost efficiency of vocational education. Several problems with operationalizing the concept of cost efficiency are explored, as are the benefits that can be derived from using it as a decision-making tool in vocational education.

George Copa provides some insights into understanding how the information received from cost-effectiveness analysis can be utilized for decision-making. He presents: (1) the major management decisions which affect vocational education, (2) alternative concepts of the purposes of vocational education, and (3) six economic principles which can be used as a guide for sorting through and organizing existing and potential information relating effectiveness to costs.

The nominal group technique (NGT) is applied to identify priority problems in the developmental strategies. In improving cost-effectiveness, the three top priority problems are identified as: (1) lack of consensus on goals, (2) limited resources, and (3) lack of adequate information. The three top priority problems in increasing cost efficiency are: (1) ignorance of cost efficiency techniques, (2) class size/student recruitment, and (3) lack of adequate budgeting and accounting system. In improving the cost-effectiveness of vocational programs, the three top problems are identified as: (1) lack of reliable data/follow-up studies, (2) fear of results/manipulation, and (3) communication.

Three technique papers focus on: (1) determining program objectives and outputs, (2) analyzing program costs, and (3) computing cost-effectiveness measures for vocational programs. Roderick McKinney explains the rationale and procedures for determining program target goals, as specified in the Indiana Cost-Effectiveness Analysis Model, and the practical application of the model.

Don Pennington defends the rationale for program cost analysis in vocational education against criticisms expressed by school personnel. Then he explains the cost analysis scheme as developed in the Indiana Cost-Effectiveness Model and discusses the implications of designing a cost analysis system to provide information and service to many different groups.

Jin Eun Kim explains the relationship of the cost-effectiveness analysis to management systems such as accountability, planning-programming-budgeting (PPB), and management by objectives (MBO). Then he presents the formulas and procedures for computing the cost-effectiveness measures and explains how to interpret and utilize the measures for vocational program evaluation and planning.

In conjunction with technique papers, guidelines and hypothetical data are provided for cost-effectiveness analysis of vocational programs. The results from the practical analysis are illustrated for training purposes through the small group workshops.

With regard to using this handbook, some concluding remarks follow:

1. The handbook attempts to explore developmental strategies for improving the cost-effectiveness of vocational programs. Although the attempt is exploratory, the ideas derived from the strategy papers will be helpful in improving program effectiveness, cost efficiency, and cost-effectiveness of educational programs.

2. The nominal group technique is applied to identify priority problems in the developmental strategies. The identified problems should be considered for research grant programs. Research to solve these problems will speed implementation of the developmental strategies for improving the cost-effectiveness of vocational programs.

3. The cost-effectiveness analysis techniques as developed in the Indiana Model can be applied to determine program objectives, to analyze program costs, and to compute cost-effectiveness measures for program evaluation and planning purposes.

4. The opportunity for training workshops should be expanded to states which are interested in improving the cost-effectiveness of vocational programs. Repeated workshops will increase the utility of the cost-effectiveness strategies and techniques in improving vocational programs.

5. This initial effort should be extended to conducting feasibility studies of the developmental strategies and analytical technique through cooperative efforts between professional researchers and practitioners.

APPENDICES

Appendix A

PROGRAM OBJECTIVES AND TARGET GOALS

OBJECTIVE 1. *Aid students enrolled in vocational education to successfully complete a secondary occupational program.*

1-a. _____percent of the student population will be enrolled in the secondary vocational program during the 19__ - 19__ school year.

1-b. _____percent of the students will complete the program requirements.

1-c. _____percent of the student completions will have on-the-job occupational experience.

1-d. _____percent lower dropout rate will occur in the vocational program than the dropout rate for the entire school.

1-e. _____percent of the student completions will rate their program to have satisfactorily met their educational goals.

1-f. _____percent of the student completions will indicate they would recommend their vocational program to other students.

OBJECTIVE 2. *Assist special student groups to successfully achieve in a secondary vocational program.*

2-a. _____percent of the persons identified as special education students will be enrolled in the vocational program (mainstream).

2-b. _____percent of the disadvantaged students will be enrolled in the vocational program.

2-c. _____disadvantaged persons (economically and/or educationally) will complete the secondary vocational program.

2-d. _____disadvantaged students (economically and/or educationally) will participate in work-study programs.

2-e. _____handicapped persons (physical and/or mental) will successfully complete the secondary vocational program.

2-f. _____exceptional youths will complete the secondary vocational program.

APPENDIX A, continued

2-g. _____percent of the students enrolled will represent the sex minority in those programs traditionally considered sex-stereotyped.

2-h. _____percent of the students classified in special student groups who can benefit from a related or enabling skills course will be enrolled in such courses.

2-i. _____percent of the students enrolled in related or enabling skills courses will attain minimum competencies in order to benefit from vocational or preparatory programs.

2-j. _____percent of the students classified in special student groups will rate their vocational program as satisfactorily meeting their educational goals.

2-k. _____percent of the special student group completions will indicate they would recommend their vocational program to other students.

OBJECTIVE 3. *Provide vocational education for secondary school youth in accordance with their occupational preparation.*

3-a. _____percent of the students available for and having sought employment will be employed full-time in less than fifteen weeks after graduation. (Consider military and apprenticeships as employed.)

3-b. _____percent of the graduates available for and having sought employment in their specialization will be employed in their specialization in less than fifteen weeks after graduation. (Include military and apprenticeships if in the area of specialization.)

3-c. _____percent of the graduates available for employment will be employed in their specialization or in a position they considered related to their area in less than fifteen weeks after graduation. (Include military and apprenticeships in specialization or related area.)

3-d. _____percent of the enrollees who terminate schooling before completing program requirements will find their first full-time job in the occupation for which they were being trained or a related area. (Include military and apprenticeships if in specialization or related area.)

APPENDIX A, continued

3-e. _____percent of the graduates of any licensed occupation program who apply for and take the exam will pass.

3-f. _____percent of the students responding on a follow-up study will indicate they are satisfied with their job.

3-g. _____percent of the students employed six (6) months after graduation will indicate that their skill preparation was adequate for their present job.

3-h. _____percent of the graduates will indicate they were adequately prepared to work with supervisors, co-workers and subordinates.

OBJECTIVE 4. *Provide leadership development activities for students enrolled in vocational programs through a youth organization functioning as an integral part of the vocational instruction.*

4-a. _____percent of the students enrolled in the vocational program will have taken an active part in youth organization (i.e., VICA, FFA, FHA, etc.) activities for the school year.

4-b. _____percent of youth organization participants will rate the activities as meeting their needs and interests.

OBJECTIVE 5. *Provide guidance and counseling services (career development) information appropriate to continued education or employment for students enrolled in vocational programs.*

5-a. _____vocational students will receive career counseling and guidance services.

5-b. _____students will receive career development information during the school year 19__ - 19__.

5-c. _____percent of the students will rate career guidance and counseling services as adequate after completion of their vocational program.

5-d. _____percent of the students receiving exploratory career information will rate the experience as having influenced their career choice.

APPENDIX A, continued

OBJECTIVE 6. *Provide vocational programs to fulfill the requirement of the labor markets and the employment community's manpower needs.*

6-a. _____percent of the student completions will be working in the employment community serviced by the school corporation.

6-b. _____percent of the student completions will seek employment external to the employment community in which they were trained.

6-c. _____percent of all vocational students will be enrolled in the vocational program which corresponds to the highest employment community and manpower occupational needs. (Projected)

6-d. _____employers will value the vocational program as a source of trained manpower.

6-e. _____employers will indicate that the employees' vocational preparation was critical in the employment decision.

6-f. _____employers will rank the employees' skill and knowledge level at a minimum of fairly skilled or above.

6-g. _____employers will indicate job advancement is related to training received in the vocational education programs.

6-h. _____employers will rate the employees' on-the-job maturity factors at a minimum mean of good or above.

OBJECTIVE 7. *Encourage vocational graduates to continue their education after completion of their secondary program.*

7-a. _____percent of the students who complete the vocational program will enroll in advanced study programs.

7-b. _____percent of the students enrolled in advanced study programs will be in the same program specialty as their secondary vocational program.

7-c. _____percent of the students enrolled in advanced study programs will be in their specialization or in programs which they consider related to their secondary vocational programs.

7-d. _____percent of the students enrolled in advanced study programs will consider their secondary vocational program to have been instrumental in their decision to continue their education.

7-e. _____percent of the students enrolled in advanced study programs will indicate their vocational program prepared them for their pursuit of advanced study.

Source: Kim, J.E., & Harris, R.C. *A Cost-Effectiveness Analysis Model for Secondary Vocational Programs.* Bloomington, IN: Indiana University, 1976, pp. 94-97.

Appendix B

HIGH SCHOOL CORPORATION (9-12th) INFORMATION

HYPOTHETICAL DATA

FULL-TIME EQUIVALENT TEACHERS:		66
AVERAGE DAILY MEMBERSHIP (ADM):		1,200
MALE	650	
FEMALE	550	
DISADVANTAGED	250	
HANDICAPPED	60	

VOCATIONAL PROGRAMS:

	STUDENTS	TEACHERS (FTE)
AUTO BODY	45	2
DATA PROCESSING	60	2
HORTICULTURE	50	2
HEALTH OCCUPATION	35	1
DISTRIBUTIVE EDUCATION	70	2
	260	9

NUMBER OF TOTAL SCHOOL DAYS:	180
BUILDING USE:	
HOURS PER DAY FOR VOCATIONAL PROGRAMS	6
HOURS PER DAY FOR ADULT EVENING PROGRAMS	4
TOTAL SCHOOL BUILDING:	135,000 SQ FT
INSTRUCTIONAL SPACE FOR VOCATIONAL PROGRAMS:	38,000 SQ FT
ORIGINAL BUILDING COST:	$7,000,000

Appendix C

PROGRAM COST ANALYSIS FORM

HYPOTHETICAL DATA

	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
1. Salaries for instructional staff ($)	24,000	28,000	22,000	11,000	20,000
2. Fringe benefits ($)	1,550	1,550	1,550	775	1,550
3. Travel costs ($)	400	400	400	200	400
4. Supplies & materials ($)	2,500	1,800	1,200	700	1,200
5. Costs of equipment & furniture ($)	12,300	46,500	12,000	15,000	15,000
6. Building use costs ($)					
a. Instructional space for vocational programs (sq. ft.)	9,600	6,600	6,500	3,000	6,000
b. Total building space (sq. ft.)	135,000				
c. % instructional space for vocational programs (a ÷ b)					
d. % time in use of vocational programs	1,080 / 1,800	1,080 / 1,800	1,080 / 1,800	1,080 / 1,800	1,080 / 1,800
e. Time/floor unit (c x d)					
f. Original building cost ($)	7,000,000				
g. Life expectancy (years)	40				
h. Total annual depreciated costs ($)	175,000				
i. Annual depreciated costs for vocational programs (h x e)					

APPENDIX C, continued

	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
7. Direct costs - total ($)					
8. Student support services total costs ($)	28,000				
9. % average daily membership for vocational programs over total ADM	45/1,200	60/1,200	50/1,200	35/1,200	70/1,200
10. Student service costs for vocational program (8 x 9)					
11. Instructional staff support service total ($)	24,000				
12. % FTE teachers for vocational programs over total school FTE	2/66	2/66	2/66	1/66	2/66
13. Instructional staff service costs for vocational programs ($) (11 x 12)					
14. Central administration support service total costs ($)	132,000				
15. Central administration support service costs ($) (14 x 9)					
16. School administration support service total costs ($)	52,000				

APPENDIX C, continued

	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
17. School administration support service costs for vocational programs (16 x 9)	_____	_____	_____	_____	_____
18. Plant operation and maintenance total costs ($)	----------92,000----------				
19. Plant operation and maintenance costs for vocational programs (18 x 6e)	_____	_____	_____	_____	_____
20. Central support service total costs ($)	----------5,000----------				
21. Central support service costs for vocational programs (20 x 12)	_____	_____	_____	_____	_____
22. Indirect support costs (10+13+15+17+19+21)	_____	_____	_____	_____	_____
23. Total costs (7 + 22)	_____	_____	_____	_____	_____
24. Number of enrollments	45	60	50	35	70
25. Cost per enrollment (23 ÷ 24)*	_____	_____	_____	_____	_____
26. Average or budgeted costs per enrollment	1,100	1,500	1,200	1,000	900
27. Cost efficiency index (25 ÷ 26)*	_____	_____	_____	_____	_____

*Indicates cost efficiency measures which may be computed at the next workshop session.

Appendix D

ACTUAL PROGRAM OUTPUTS

HYPOTHETICAL DATA

Objectives	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
1-a	12%	5%	8%	10%	15%
1-b	45%	40%	40%	70%	75%
1-c	60%	70%	40%	90%	80%
1-d	5%	2%	3%	6%	6%
1-e	70%	50%	60%	70%	55%
1-f	25%	20%	25%	30%	30%
2-a	5%	---	10%	---	5%
2-b	25%	15%	20%	25%	20%
2-c	12	8	10	12	10
2-d	12	8	10	12	10
2-e	10	---	5	---	5
2-f	10	10	5	15	12
2-g	10%	20%	20%	20%	20%
2-h	80%	---	85%	---	70%
2-i	40%	---	45%	---	45%
2-j	80%	---	80%	---	75%
2-k	70%	---	70%	---	65%
3-a	80%	80%	75%	90%	80%
3-b	70%	60%	60%	90%	65%
3-c	70%	60%	55%	80%	50%
3-d	25%	30%	25%	30%	20%
3-e	---	---	---	70%	---
3-f	70%	70%	60%	70%	70%
3-g	70%	70%	60%	70%	70%
3-h	60%	60%	50%	60%	65%
4-a	90%	70%	90%	80%	95%
4-b	50%	60%	80%	70%	50%
5-a	40	50	40	30	60
5-b	40	50	40	30	60
5-c	50%	60%	50%	60%	55%
5-d	50%	60%	50%	60%	50%

APPENDIX D, continued

Objectives	Auto Body	Data Processing	Horti-culture	Health Occupations	Distributive Education
6-a	60%	50%	80%	70%	65%
6-b	40%	50%	50%	30%	30%
6-c	30%	20%	20%	30%	25%
6-d	10	5	10	20	10
6-e	8	4	7	10	5
6-f	8	4	7	10	5
6-g	8	4	7	10	5
6-h	8	4	7	10	5
7-a	20%	20%	15%	10%	10%
7-b	70%	80%	90%	90%	80%
7-c	80%	70%	40%	80%	50%
7-d	70%	80%	90%	90%	70%
7-e	60%	60%	70%	70%	60%

REPORTS FROM COST-EFFECTIVENESS STUDY PROJECTS

Kim, J.E. & Harris, R.C. *A cost-effectiveness analysis model for secondary vocational programs: Technical report.* Bloomington, IN: Indiana University, 1976. (ERIC Document Reproduction Service No. ED 130 081, CE 008 487)

Kim, J.E., Harris, R.C., & Ruby, D.D. *Cost-effectiveness analysis of secondary vocational programs: Administrator's manual.* Bloomington, IN: Indiana University, 1976. (ERIC Document Reproduction Service No. ED 130 082, CE 008 488)

Harris, R.C. & Kim, J.E. *Cost-effectiveness materials for locally conducted secondary school vocational education program investigations: Final report.* Bloomington, IN: Indiana University, 1976. (ERIC Document Reproduction Service No. ED 130 083, CE 008 489)

Kim, J.E. *A cost-effectiveness/benefit analysis model for postsecondary vocational programs: Technical report.* Bloomington, IN: Indiana University, 1977. (ERIC Document Reproduction Service No. ED 151 560)

Kim, J.E. *Cost-effectiveness/benefit analysis of postsecondary vocational programs: Administrator's manual.* Bloomington, IN: Indiana University, 1977. (ERIC Document Reproduction Service No. ED 151 559)

Kim, J.E. *Development of a cost-effectiveness/benefit analysis model and user's manual for postsecondary vocational programs: Final report.* Bloomington, IN: Indiana University, 1977.

Kim, J.E. *Diffusion of the cost-effectiveness analysis system for improving secondary vocational program management: A conceptual framework and a statewide conference.* Bloomington, IN: Indiana University, 1978.

Kim, J.E. *Developmental strategies and analytical techniques for improving cost-effectiveness of vocational programs: Handbook.* Bloomington, IN: Indiana University, 1978.

Kim, J.E. *National workshop and states' follow-up activities for improving cost-effectiveness of vocational programs: Workshop report.* Bloomington, IN: Indiana University, 1978.

Kim, J.E. *National priority training program #1: Developmental strategies and analytical techniques for improving cost-effectiveness of vocational programs: Final report.* Bloomington, IN: Indiana University, 1978.